The STT 1982 HOME SATELLITE TV HANDBOOK

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Satellite TV Handbook

HOME SATELLITE TV RECEPTION HANDBOOK

BY
Bob Cooper, Jr.

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Satellite Television Technology
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COOP (right) with Dr. Vladimir Zworykin (left), inventor of the all-electronic television system, discussing the changes in television technology during an SPTS event.

WELCOME...

...to the exciting, fast-changing world of satellite communications! If this is your first in-depth exposure to satellite television, you have timed your 'entry' into this modern communications technology field at a very opportune point in history. **These** are the 'good old days' which pioneers in this field will recall fondly in the years ahead.

When Susan and the kids and I installed the world's first privately-owned satellite television 'home terminal' several years ago we knew we were pioneering in a new area but had no concept of how others would react to our efforts. I made the decision to install a 'backyard' terminal simply because I was challenged by the opportunity. Nobody had done it before...that seemed like a good enough reason to do it! Little did I know the forces this decision would set in motion. Today perhaps 26,000 homes like ours have private satellite TV service. Many of these 'terminals' have been hand constructed by individuals with a technical flair; people who wanted to see **if** they too could do this 'impossible task'. Many knew they could do it...their challenge was to do it cheaply. And as we shall see here, some have done it for less than $1,000 in cold-hard-cash.

Perhaps because my 'trade' is writing there has been a substantial amount of 'publicity' concerning this latest communications phenomenon. Articles written for a wide variety of publications (Mother Earth News, Popular Science, Videoplay, Video, 73, Entrepreneur et al) have appeared during the past. Television coverage by CBS (Cronkite News and Morning News), NBC (Tom Snyder's Prime Time program) has added fuel to the burning fires. All of this 'notoriety' has changed the lives of the Coopers just as satellite television is changing the lives of all it touches.

Those who are affected most (some might say infected!) however are those thousands who have attended and will attend our thrice-annual Satellite Private Terminal Seminars; an event held at different USA locations where for three days the leading equipment designers and system installers conduct 'seminar classes' on this new technology and in so doing send home hundreds of new 'converts' to this science.

This Handbook is designed to lay a foundation for your own entry into this field. It will assist you to get started on your own or with others to build, install or even buy outright your first satellite TV terminal. Carefully read, this Handbook will save you thousands of dollars and hundreds of hours of your time in accomplishing this task. The 'Sourcebook' section to the rear provides dozens of places to go for help in locating equipment, circuits, equipment you can install or firms who will 'turnkey' (i.e. install for you) your system.

Thank you for being with us...and welcome to the most fascinating communications technology in the history of mankind!

Bob Cooper, Jr.
Satellite Television Technology

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WHERE AND WHEN IT ALL BEGAN

The first use of a manmade earth orbiting satellite to relay television pictures occurred in 1962 with an early generation satellite named **Telestar**. This early satellite, like many others lifted into orbit during the 60's, was in term's of today's sophisticated technology a 'low-orbit' satellite. Lacking the rocket power required to lift and the rocket control systems to precisely 'fly' a weighty device such as a communications satellite into 'deep space' and keep it there, early satellites were lifted just far enough above the earth where if they kept moving forward they would stay in orbit for many months or years before gravity dragged them back down again. A communications satellite is nothing more than a 'relay station' which as we shall see means it has built into it electronics to receive a transmission from earth and then 'turn around' that transmission and send it back down to earth again; relaying the original earth transmitted message in the process.

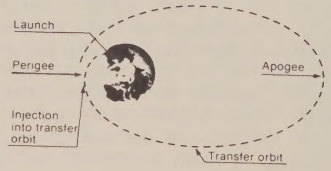
Low orbit satellites (and for many purposes such as mapping and surveillance this system is still in use) have to keep moving or they will fall back to earth after a few minutes or hours. So they are launched in a precise earth-circling orbit or trajectory which skims them across the top of our 'ionosphere' at speeds approaching 18,000 miles per hour. They circle the earth in any of several directions, either from east/west (west/east) or north/south (south/north). Or, some 'slanted' angle in between. If such a satellite is equipped to relay radio or data or television signals the two or more stations on the earth using the satellite for this purpose must be equipped to point their receiving/transmitting antennas at the low orbiting satellite as it 'comes into view', passes through the sky overhead or near-overhead, and then finally disappears behind the earth's curvature on the opposite horizon.

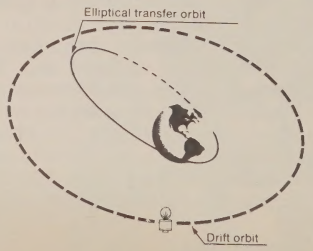
Because the satellite is literally 'in flight', such a low-orbiting satellite must be 'tracked' by the ground stations utilizing it. This results in large, complex, often computer-controlled antenna systems and the cost of such systems can be very high. Furthermore such systems have a usefulness that extends for only that period of the day when the satellite is passing through the **visible** sky at each location; and for any two points on earth to communicate via the satellite relay, both must be able to **'see'** the satellite trajectory at the same time. Obviously as nice as this system is, it is also a very expensive system to implement and because it is only good for

perhaps 30 to 60 minutes of communications time per day between any two locations, it has limited applications.

The solution to this 'problem' was a satellite that would be launched into a 'high orbit'; one so high that it could be made to 'look like' it was not moving at all. If such an orbit could be perfected the satellite relay station would 'hover' in space like a small manmade 'moon' and then earth-bound stations linked to it would simply point their transmitting/receiving antennas at this 'moon' and it would relay communications around the clock, twenty-four hours per day, to all stations on earth associated with the satellite.

The postulation for such a system was originated in 1945 by a science fiction writer named **Arthur C. Clarke**. If you are a Sci-Fi fan you may recall his name as the author of such classics as **2001: Space Odyssey, The Lion of Commarre** and some 50 others. Clarke is also a brilliant mathematician and while doing military work for the British government in 1945 he conceived something that later became known as the geo-stationary orbit. In his postulation Clarke suggested that a space relay station be precisely orbited to a distance of 22,300 miles above the earth's actual equator. As this altitude the satellite would maintain a 'forward speed' precisely controlled so that the orbit speed of the satellite 'around the earth' would exactly match the rotation of the earth on its axis. In effect, the satellite 'stands still' in space always appearing to be in the same spot in the sky.

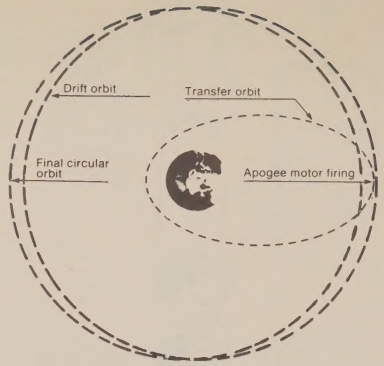




Clarke was far ahead of mankind's ability to achieve his suggestion but he was dead on-target in his plan and conception. For, in 1963, the Hughes Aircraft Company constructed a special satellite later named **Syncom** which did precisely what Clarke had suggested 18 years prior.

This tricky manuever didn't just happen; it took tens of millions of 1960 era dollars and all of the technology at America's command to bring it off. The satellite had to be very compact and lightweight since every pound added in satellite weight required more expensive, complex and state-of-the-art rocketry. The satellite is first launched into a combination of a low-orbit and a high orbit. **At perigee** (the portion of the orbit closest to earth) the satellite acts like a low-orbit satellite. **At apogee** (the portion of the orbit furthest from earth) the satellite acts like a high orbit package. Once into this 'inclined elliptical orbit' the satellite's systems are checked out and then very precise rocketry is employed to transfer the satellite from the elliptical orbit into its final circular (or geo-stationary) orbit.

YES - this is all quite complicated and even understanding it is not essential to having your own satellite TV terminal. BUT - there is one thing you should understand from all of this; by magic or whatever, the satellite you will receive your multiple channel television service from is stationary in the sky. **It does not move**, as far as you are concerned; it simply 'sits there in space' as a relay station and to receive its transmission simply requires that you point the proper type of antenna



connected to the proper type of receiving equipment off up-there in space towards the satellite. Once you have done this 'alignment' procedure, you can then forget all about orbital mechanics and simply enjoy the television it makes possible. Short of a catastrophic failure on board the satellite, you won't ever have to give the satellite itself a second thought.

NOW - just on the chance you have an inquisitive mind, you might be interested in some of the 'satellite facts'. Let's skim the top of a few just so you have a talking knowledge of the satellite itself:

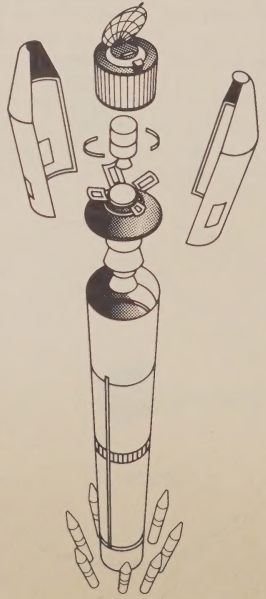
1)Present day satellites are lifted into space aboard our most powerful rocket systems. The 'payload', or the satellite itself, may weigh between 2,000 pounds and 3,000 pounds.

2)Satellites are very compact for the amount of equipment (electronic) and rocketry on board. Typical sizes are 8-10 feet long and 6-8 feet in diameter. Some designs 'unfurl' large solar panels after the satellites achieves its geostationary/Clarke orbit position while others cover the outside of the satellite cylindrical container with solar power collection cells.

3)All geostationary/Clark orbit satellites carry a seven to ten year supply of rocket fuel on board which is released through small nozzles called thrusters on command from on-ground flight controllers to insure the satellites maintain their 'station' or location assigned in space.

4)Each communications satellite contains one or more microwave frequency range radio receivers and one or more microwave frequency range radio transmitters. Internally within the satellite, the receiver is cross-connected to the transmitter and whatever radio/television signals as are received by the receiver are re-transmitted back to earth by the transmitter.

The satellite is a very complex electronic/mechanical/electrical/rocketry package. It must contain a small computer to interpret the flight instructions sent from the ground and to monitor as many as 200 different

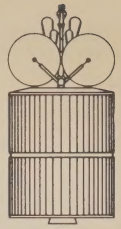


points of internal operation. In addition to the 'relay-receivers' it also contains one or more 'telemetry' receivers; special receivers which receive instructions from flight controllers located at ground stations which monitor and 'fly' the satellite 24 hours per day. The 200 or more points internal to the spacecraft (internal temperatures, power and electronic operating voltages and currents, rocket thruster operating parameters, fuel supplies, etc.) which are monitored by the on-board computer are converted to special 'telemetering' radio signals which are sent constantly back to earth on a special radio transmission channel. On earth the flight controllers, operating something called TT & C stations, constantly monitor all of this data with the aid of large on-ground computers. At the first indication that something is operating outside of normal 'limits' the flight controller instantly springs into action to 'ask' the satellite for more detailed information. REMEMBER - the satellites cannot be repaired in space. If something goes wrong, the satellite must fix itself!

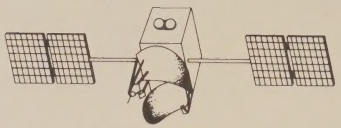
This is why something called redundancy is built into every satellite; spare circuits or parts or systems so arranged that if a primary part or circuit fails or acts up, the ground controller can direct the satellite to 'switch around' the failed part or segment and restore service.

All of this adds to the complexity and cost of a typical communications satellite. What might such a system cost? In 1982 dollars a typical RCA/Western Union satellite costs between 25 and 30 million dollars each! PLUS - on top of the cost of the satellite itself the operator of the 'bird' must pay for the launch of the satellite; a fee that exceeds the cost of the satellite itself. It is no wonder then that the $50,000,000 plus system (i.e. the satellite in operation) is treated so carefully with 24 hour attention.

ANIK-III



INTELSAT IV-A



RCA SATCOM

There is more. Just as the satellite cannot be repaired in space (even with the forthcoming 'Space

Shuttle' program geostationary/Clarke orbit satellites must repair themselves since the early Shuttle program will not be able to 'fly' to a 22,300 mile height), so too must it power itself in space. Running a 22,300 mile extension cord is not a feasible solution; and hauling up into space bulky fossil fuels to operate on board 'power generators' for the seven to ten year life is also impractical. So satellites tap the power of the sun; relatively large, high technology solar panels made up of thousands of individual solar cells all working together collect the sun's rays and convert it into electrical operating power. This power is stored for short periods of time in special (NiCad) batteries. Even with this storage capacity the satellites depend upon a constant source of sunlight to stay operating; WESTAR and COMSTAR and (Canadian) ANIK satellites for example must shut down major portions of their operations for a few hours per day during certain periods of the fall and spring when the alignment of the sun, the earth and the satellite throws the satellite into an eclipse (i.e. into a short period of darkness caused by the earth's shadow). Only the RCA (domestic) satellites have battery reserves to allow them to operate 'normally' through eclipse periods.

Finally there is the capacity of the satellites to consider. By international agreement, more than 100 nations of the world have approved specific microwave frequency bands for satellite operation. Remember the satellite is a relay station; whatever is received by the receiver(s) is re-transmitted by the transmitter(s). The frequency band most commonly employed for this service, on an almost world-wide basis, is as follows:

1) **Downlink** (i.e. satellite to earth): 3,700 to 4,200 megahertz (MHz)
2) **Uplink** (earth to satellite): 5,900 to 6,400 megahertz (MHz)

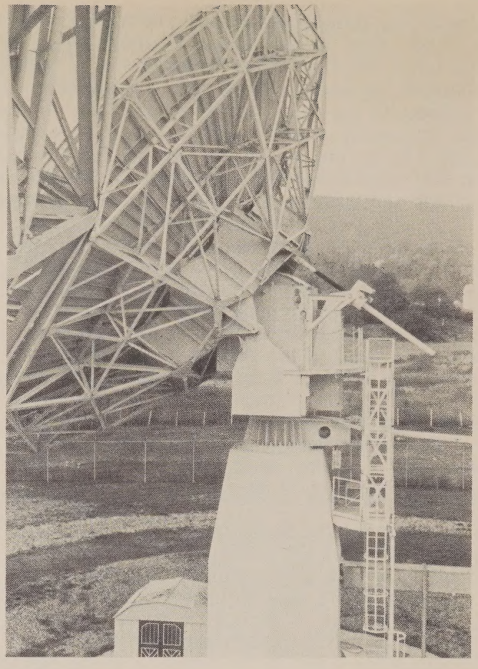
This is a 'band' of frequencies 500 MHz wide (3,700 to 4,200 and 5,900 to 6,400). A single television transmission occupies approximately 40 MHz of this space. That means there is 'room' within the 500 MHz

WESTAR CONTROL - 'flight' engineers sit in front of this console 24 hours per day keeping tabs on all three WESTAR birds; RCA and COMSTAR have similar installations.

'band' for 12 such transmissions simultaneously (plus a little extra capacity - 20 MHz - for 'housekeeping' or telemetering and control operations).

The Canadian ANIK series satellites and the Western Union WESTAR satellites have 12 separate channels (they call them **'transponders'** in this business) and if your satellite terminal was pointed at an ANIK or WESTAR satellite it is theoretically possible for you to 'tune' your receiver 'across' 12 **separate** television programs; one right after the other as you turn the tuning dial.

Meanwhile - on the RCA (SATCOM series) and ATT/GT&E (COMSTAR series) satellites the very same satellite receiver could theoretically tune in up to (a maximum of) 24 different television channels. How is that possible if both the ANIK/WESTAR and the SATCOM/COMSTAR satellites all share the same 500 MHz 'band'? WELL - RCA and ATT/GT&E have designed their satellites so that two separate channels or transponders 'share' the same band of frequencies. They do this by interleaving the channels in such a (clever) way that they are able to get twice as many 'channels' out of the same 500 MHz of 'space'. We'll talk more about what this means further on in this Handbook. FOR NOW - accept that the very same equipment at your home can tune in either (a maximum



TOO BIG TO CARRY - this 60 foot uplink antenna at Western Union in Vernon Valley, NJ is part of an antenna 'farm' designed to keep tabs on satellites and signals going to them.

of) 12 channels on ANIK/WESTAR or 24 channels on SATCOM/COMSTAR without any equipment modifications. We know it sounds confusing at this point - we'll see how this is possible shortly.

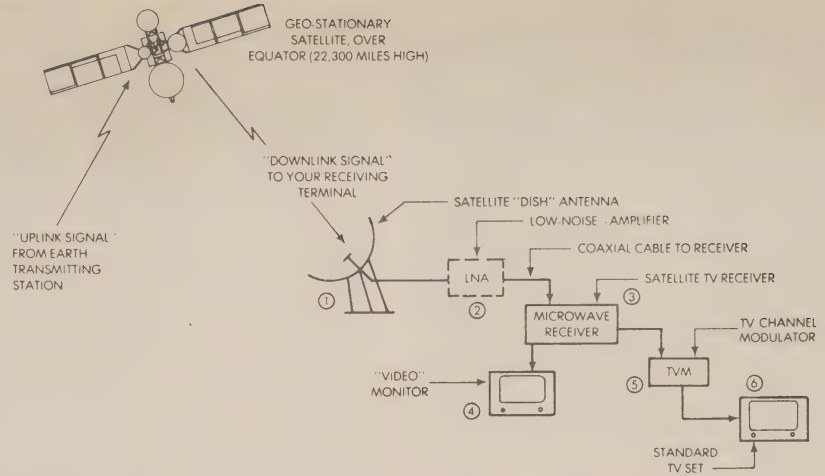
The technology of the satellites is of course fascinating. SADLY - very little has been written about it in even modern textbooks, so recent is the technology. There are several references given in the 'Sourcebook' section to the rear for those who may wish to increase their depth of this knowledge.

WHAT THE SYSTEM REALLY IS...

Inspite of the great mystery that seems to surround the satellite system, and the admittedly complex control and operational sub-systems, the basic satellite is actually quite a simple 'machine'. Here is how simple it is:

1) **A television program originates** in a studio and is carried to a satellite uplink station via cable, 'terrestrial' microwave or some combination of the two. The program material is fed into an uplink transmitter which employs a very large transmitting antenna which is aimed precisely at that spot in the sky where the intended satellite is in geostationary/Clarke orbit.
2) **The signal travels** through the lower atmosphere and soon it is in space heading for the satellite. In approximately 1/10th of a second the signal arrives at the satellite where the on-board receiver receives it, amplifies it, and then 'converts' (i.e. translates or changes the frequency) to a new frequency; the one intended for the downlink (i.e. space to earth).
3) **The downlink transmitter** on board further amplifies or boosts the signal, sends it to a special downlink antenna pointed back towards earth and the signal is once again on its way back towards the intended 'target' area.
4) **As the signal comes back** through the lower atmosphere it has spread out to cover a vast area; perhaps all of the region from say Alaska on the northwest to Puerto Rico on the southeast, New Brunswick on the northeast to Hawaii on the southwest. In fact it is possible for a single satellite to 'cover' (i.e. service) up to 40% of the earth's surface at one time!

Arthur C. Clarke in his 1945 postulation depicted a simple network of **three** satellites, each providing direct television transmission to 40% of the earth's surface, with the three Clarke-positioned satellites evenly spaced around the world at 120 degree intervals (remember the earth is essentially a 'ball' and a ball has 360 degrees like any circle). It is interesting to note that the international (INTELSAT) satellites which today relay radio, television and telephone messages all around the world have



indeed adopted this '120 degree spacing' along the geostationary/Clarke orbit belt; just as the far-sighted Mr. Clarke said they should some 37 years ago!

5) **The satellite signal spreads out** very 'evenly'; and minor engineering differences aside, a home terminal viewer in Walla Walla will receive the same quality and quantity of signal as a home viewer in Winston-Salem. Right away that separates satellite television from so-called 'terrestrial' television; the kind some 70,000,000 US homes presently enjoy.

Regular 'terrestrial' television is limited in its range to something engineers call 'line of sight'. That means, in lay terms, the television transmitter serving your area deliberately attempts to install its transmitter and transmitting antenna on the highest piece of ground around. If no high ground is present, they build a tall

tower. Why? Because the higher they are the further they can 'see' and since television signals cover only an area they can 'see' reliably, height is very important.

And the satellite? Well, think of its geostationary/Clarke orbit of 22,300 miles above the equator as being a very (very,very, etc.) tall tower. Here is this complex little box of rocketry and electronics sitting 'atop' a mythical pole 22,300 miles high. At that 'height' the transmitting antennas of the satellite can 'see' a very-very long ways. As noted, they can 'see' fully 40% of the earth's surface at one time!

Visionary Clarke in 1945, before virtually any of our present network terrestrial television system was operational, suggested that mankind would be much better off developing a 'satellite television system' than an expensive network of 'terrestrial' stations. It turns out he was right; one satellite can cover every nook and cranny of the United States and virtually all of Canada (south of the Artic Circle)...plus most of Mexico, vast areas of the Caribbean including Bermuda on the east and west to Hawaii. And for far less money it should be noted. One $50,000,000 satellite can provide up to 24 channels of television for all of this area while it would take untold thousands (perhaps 40,000) 'terrestrial' television stations to do the same thing at a total cost of perhaps forty **billion** dollars! Is there a future for satellite television? Is the sky blue!

NOW in all fairness it should be pointed out that not all satellites are created equal. Of course ANIK/WESTAR have 12 channels while SATCOM/COMSTAR have 24 (one pre-supposes that future ANIK and WESTAR 'birds' would also have 24 channel capacity). But there are other differences as well.

DOMESTIC vs. INTERNATIONAL

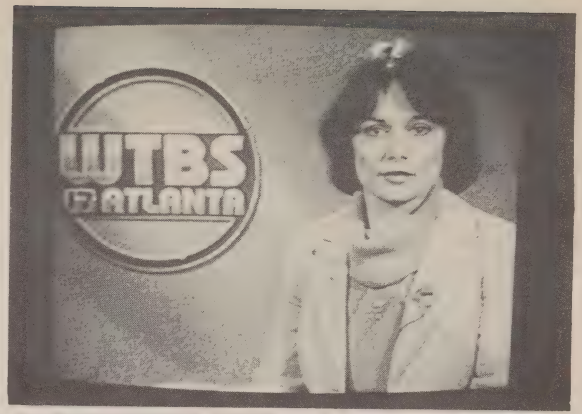
The first satellites put into geostationary/Clarke orbit were put up and funded by an international consortium of nations and some private investor dollars. They formed what is now known as INTELSAT, a 100+ nation cooperative which shares the costs, uses and even revenues of these space relay stations. Virtually all of the nations of the world which are a part of INTELSAT are

WALL TO WALL 2" VIDEOTAPE - machines installed at RCA's Vernon Valley [N.J.] uplink site feed SHOWTIME and other programming to the appropriate transponder on the appropriate bird.

outside of the Communist nations. Which suggests, quite correctly, that in addition to INTELSAT there would also be a network of communication satellites operated by the Communist bloc countries. It is called INTERSPUTNIK and while at this writing (May 1982)it is not as fully 'developed' as the INTELSAT system there is every indication that it will be as complex in just a few short years. Already certain 'clashes' have taken place.

INTELSAT satellites operate in the same frequency band (3,700 to 4,200 MHz downlink) as the ANIK/WESTAR/SATCOM/COMSTAR satellites previously described. They perform about the same purposes in life except that they are largely intended to actually cover the 40% of the earth's surface each can see. While some nations (primarily in Africa and the middle east) utilize INTELSAT channels/transponders to relay telephone/radio/television communications within (i.e. intra) their country, most uses of INTELSAT are for relay of such communications between continental areas; Europe to North or South America, for example. We'll see how all of these satellites can operate within the same band of frequencies and not have interference between satellites later on.

INTERSPUTNIK satellites operate outside of the international agreements that established INTELSAT and to some extent they also operate outside of the frequency bands adopted by INTELSAT. But not entirely. The INTERSPUTNIK downlink frequency bands generally 'begin'lower in the range than our own



TED TURNER'S SUPER STATION - WTBS is now viewed via satellite in virtually all 50 states, Canada and throughout Caribbean and Central America on SATCOM FIII transponder 6 (24 hours per day).

(around 3,400 MHz) and they work up past our 'lower edge boundary' of 3,700 MHz and into our own band. In fact a number of adverturesome North American private satellite terminal operators regularly tune in television directly from Moscow on a frequency of 3,895 MHz or roughly the equivalent of the US/Canada/INTELSAT channel-transponder 10 on the dial. We'll see how you tune in the Russian ballet later on.

There have already been some conflicts in space in this area. Let's look at one which may be an indicator of things to come.

We said that not all satellites are created equal. The technical differences aside, there are purposeful operational differences as well. Recall that INTELSAT (and INTERSPUTNIK) satellites operate by design to reach or cover the full 40% of the earth's surface area they can 'see' from their chosen geostationary/Clarke orbit position above the equator. They, being international satellites, want as wide a 'reach' as possible. That's why they are up there in the first place.

Now consider Canada. A large country, scattered clear to the North Pole, and Alaska aside, wider east by west than the United States. Canada designed and made operational a 'domestic' satellite system in the early 1970's; the first true geostationary/Clarke orbit domestic system in the world (the Russians naturally make a different claim!). The Candian satellite operators wish only to cover Canada; not the 40% of the earth they could reach from their (internationally assigned) geostationary/Clarke orbit positions. So on purpose they have designed their ANIK bird satellite antennas so that they are 'directional'; that is, even though a man sitting atop the satellite could 'see' 40% of the earth's surface, the antennas on board the ANIK birds themselves **only see Canada.** They are 'directional' and like a horse wearing blinders they ignore the balance of the earth visible from their location.

A similar system was designed by a team of US space equipment manufacturers for Indonesia in the mid 70's; they call their satellites (there are two) PALAPA. This pair of birds is spotted over the equator in a position where it would best serve this island-nation. Enter the international pressures of the world; Russia decided it would launch an INTERSPUTNIK to a geostationary/Clarke orbit position very close to the PALAPA satellites; so close that in fact the Russian bird would intercept 'signals' intended **for** the PALAPA bird(s) and re-transmit them back **into Russia**. Why would the Russians wish to 'intercept' Indonesian satellite communications, and 'pirate' them away to a section of Russia? Certainly not to interfere with the Indonesians since their satellites continue to oeprate as if the Russian bird was not even present. Perhaps the Russians are simply 'testing'.

We noted that the Canadian ANIK satellite does, by design, only attempt to 'cover' Canada. The US domestic (i.e. intended for US use; including WESTAR, SATCOM and COMSTAR) satellites have similar 'directional' receiving and transmitting antennas and as a prospective viewer of these satellites you should be glad they do. Why?

WELL - remember that the satellites depend upon the sun for power. And that the solar power cells either cover the surface of the spacecraft's cylinder or they are located on large 'wings' which unfurl after the satellite is in position. In either event the amount of solar power available is limited and it must be shared by all of the systems on board.

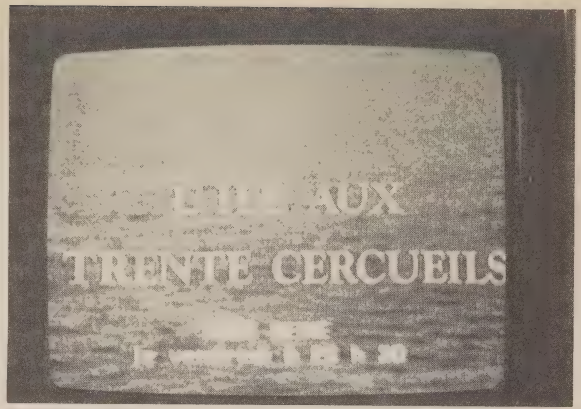
This restricts the available transmitter power on each channel/transponder; to a mighty **5-8 watts** of power. If you have a CB radio, you can identify with that power 'level'; a satellite way out there in space has the same amount of power as a 'stock' CB set!

IF the satellite has to provide coverage to **all** of the earth's surface it can see (that 40% of the earth again), the 5+watt power has to be spread evenly over a very large area. On the other hand, if the power is to be confined to a smaller area (say Canada), through the use of directional antennas, the power level present at the terrestrial receiving location will be stronger.

Think of it this way. You have a gallon container of milk. You can pour it into a 5 foot diameter child's swimming pool or you can pour it into a 20 foot diameter adult swimming pool. Think about it...the same gallon will pour into either but in the smaller child's pool it is going to be 'deeper' than it will be in the larger adult's pool.

That 5+watts of power works in the same way; by confirming it to a smaller area, it is stronger (as the milk is deeper) than it would be covering a larger area.

Why is that to your advantage? Simply because the stronger the satellite signal arrives 'on the ground' the less elaborate your receiving equipment must be to pick up the signal. In other words, 'domestic satellites' intended to cover a limited portion of the available earth produce stronger signals on the ground than the 'INTELSAT/INTERSPUTNIK' satellites intended to cover big chunks of ground.



CANADIAN FRENCH TV - ANIK-B is well received throughout much of USA, particularly north of a line from San Francisco to Atlanta; on transponder 8 of ANIK-B some 18 hours per day from Montreal.

If you live outside of the intended 'domestic' coverage areas (just as Bermuda is outside of the US or Miami is outside of Canada) there are dis-advantages to this design approach of course. We'll see how severe these dis-advantages are for those readers who live in Bermuda and might wish to 'tap in' on the US domestic satellites, or those readers in Miami who might wish to tune in a Canadian Curling game later on in this

Handbook.

SATELLITE SERVICE IS...

...different than regular television reception, unless you live very (very) close to a group of (local) terrestrial transmitters. Let's see how and briefly why.

1)**Satellite signals are very stable**. If your present television signals are good one day and poor the next with your existing terrestrial service, we say it suffers from changes in weather patterns. Satellite signals come to your location from outer space and in that 23,000 - 25,000 mile trip only the last mile or two is through any kind of weather. That means the satellite signals are virtually immune to weather changes and your picture looks just as great in a thunderstorm as it does on a clear fall day.

2)**Satellite reception quality is superb!** Remember the programming originates at a 'network' production center, is carried directly to the satellite uplink transmitter where it is 'shot' into space to satellite. The satellite turns the signal around and shoots it back to you (and tens of thousands of others). Everything about a typical satellite network is quality and you are but one-satellite-removed from the super-high-quality pictures which the studio technicians see on their own uplink control room monitors. Satellite reception is the closest thing, technically, to being in the control room where the event is taking place!

3)**Satellites are multiple channel systems.** As noted, a satellite can have the capacity to carry 12 or 24 separate, distinct programs at a time. Your home receiver is (typically) designed to tune in any of the 12 or 24 channels being beamed through the satellite at the moment. You tune in the stations or programs by turning a knob or dial on the receiver; the full range of channels is present going into your receiver and you select which one program you wish to watch at that moment by controlling the tuning knob.

4)**Satellites operate full time**. Aside from those very brief periods in the fall and spring when WESTAR and COMSTAR satellites must selectively shut off certain (but not all) channels/transponders to conserve battery power, the satellites operate twenty four hours per day. If the programming source is providing programming at 4 AM in the morning (as many now do) the signals will be there on your television set.

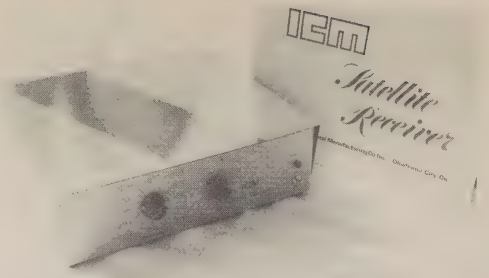
PLUS - there is the time zone impact of satellite reception. If you are located in Honolulu, for example, and you have a private satellite receiving terminal, you can start off at 1 PM and catch the '6 PM news' from New York, at 2 PM watch the 6 PM news from Chicago, and at 4 PM watch the 6 PM news from Vancouver! Conversely the 'morning movie' from San Francisco's KTVU may reach you in Puerto Rico in the middle of your local afternoon. Or if you are an adventuresome viewer, the 10 PM 'close down' news from Moscow via the Russian

Molniya satellite will reach Vancouver at 11 AM in the morning!

For US and Canadian domestic satellites the time zone situation gives the programmers some problems. A program that has been 'scheduled' for local viewing in New England at 8 PM catches most west coast potential viewers still on the freeway. HBO, SHOWTIME, Warner's The MOVIE CHANNEL and the Canadian Broadcasting Corporation's CBC North channels have elected to utilize **two separate transponders** to solve this problem. The 8 PM program is 'fed' via satellite on one transponder at the appropriate (8 PM) time slot for the east and then three hours later it is repeated on **another transponder** for the west. As a private terminal viewer this is like having a movie theater that repeats itself every three hours; if 'Hooper' is not convenient for you to watch at 8 PM your time, in the east you can watch it on the western transponder three hours later (or three hours earlier on th eastern transponder if you are in the west). It takes a little getting used to...all of this new 'freedom' from a rigid time schedule!

THE SATELLITE REACH

Earlier we described the difference between the INTELSAT satellites (40% of the earth coverage) and the domestic satellites (limiting their coverage to specific geographical areas). If you have access to the **Worldwide Communication Satellites Wallchart** (which is a part of the 'Satellite Study Package' from STT) this might be a good time to take a look at the special 'maps' found on the back side.



PRIVATE TERMINAL RECEIVER - this ICM [International Crystal Manufacturing Co., Inc.] 24 channel receiver was first shown at SPTS '79 in Oklahoma; has since become big seller in private field.

Engineers have developed a technique for forecasting how strong the satellite signal is as it reaches various portions of the satellite's intended coverage area. These maps show this coverage with a series of ellipses or egg-shaped lines. Different satellites, even within the domestic system, have different coverage patterns, the center of the maps (where the dBw number is the highest; such as 36) is called the boresight region and this is where the satellite signal is strongest.

The Canadian ANIK and the US WESTAR satellites have approximately the same patterns (these patterns are called 'footprints' in the trade) for each of their channels or transponders. So if you know the footprint for one channel for a particular bird, you know the approximate coverage for other channels on the same satellite as well. Because of their more complex design the US COMSTAR and SATCOM satellites have different footprints for various channel 'Groups'. Both the COMSAT and SATCOM birds were designed so that they could have independently controlled footprints for each of four sets of (six) transponder channels. For example, COMSTAR satellites can have one set of six channels 'boresighted' on Hawaii, another set of six channels 'boresighted' on Alaska, a third set of six channels 'boresighted' on the continental US (called CONUS) and the fourth set 'boresighted' on Puerto Rico. With this arrangement the satellite operators have the ability to remotely control, from their TT & C stations on the ground, which transponders are sending high quality signals to which areas of interest. The SATCOM satellites have a similar approach although they skip the Puerto Rico 'boresight'.

As the use of the SATCOM and COMSTAR satellites has grown, the 'switchable' boresight on COMSTAR has kind of evolved so that for most of the time all four 'boresight beams' are directed into CONUS (continental US). This simple means that while the satellites in the COMSTAR family have the built-in **capacity** to switch boresights, for the most part they keep their 'boresights' on CONUS because this is where most of the 'demand' is located.

SATCOM birds cannot be switched in boresight from the ground; to re-direct the boresight it is necessary to fire thruster rockets which move the satellite slightly so that the 'boresight' patterns for all four sets of (six) transponders (each) change together. And in actual practice at SATCOM this happens very seldom.

When all of this craziness began virtually everyone who wanted to install a satellite TV receive terminal worried a great deal about what the footprint signal levels should be for a specific area (i.e. the spot where the terminal would locate). With the proliferation of terminals in both the private and commercial sector much of this concern for footprints has disappeared; it being more convenient to simply 'look' at a terminal already in operation in the general area and the reception it provides, and then to 'copy' the equipment lash-up with your own terminal. And that brings us to the actual equipment itself and how one makes a choice in this area.

THE RECEIVE TERMINAL

In the technical jargon of the satellite industry, the system you may one day install in your home is called a 'TVRO'; which is shorthand for 'television-receive-only'' (terminal).

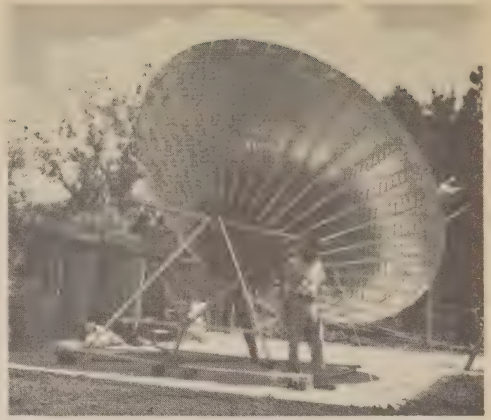
The TVRO consists of three primary parts:

1)**The receive antenna** - typically a shallow metal,

fiberglass (impregnated with fine pieces of metal or a metal screen in a 'sandwich'), or lightweight 'screen wire' dish, shaped like a (mathematical) parabola, equipped with a mechanism to mount or hold the antenna slightly above the ground where it aims more or less 'upward' into the sky. Most mounts have some method of adjusting where in the sky (azimuth) and how high in the sky (elevation) the dish is directed since you initially have to move the antenna around a bit to locate or find the satellite of interest, and having once found it, you may also wish to be able to re-direct the antenna away from the first satellite to a second (third, etc.) satellite to see what is being transmitted on them as well.

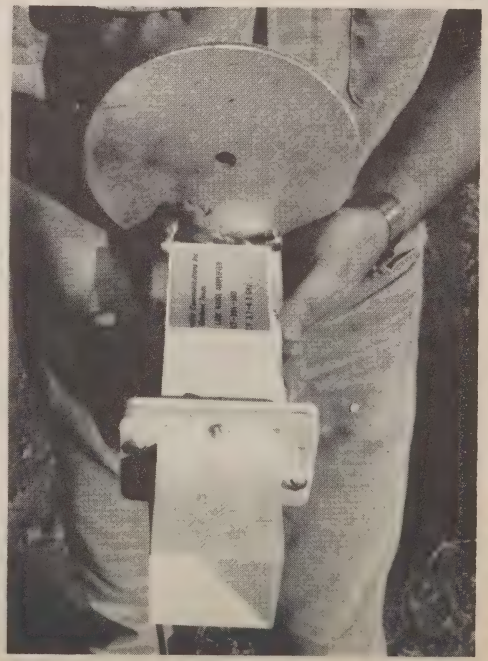
There is one basic 'rule' with satellite dish antennas; the bigger they are, in physical size, the more sensitive they are. 'Big' is a measurement of the diameter (or aperture as it is called) of the antenna and the bigger the aperture the more 'gain' the antenna has. Which is simply a way of saying bigger antennas will receive weaker signals, or produce stronger signals to the receiver.

2) **The Low Noise Amplifier** (LNA) - is akin to the television 'signal booster' which folks who live in poor reception areas must install on their antennas. The LNA is a space age electronics gadget that amplifies or 'boosts' (in strength) the extremely weak satellite signals picked up by the dish antenna. It installs on the antenna and without it you would get no pictures at all or extremely poor pictures. It must install at a special spot on the antenna where it mates directly with something called a 'feed-point horn'; a little metal box with flared edges which collects the energy (like a funnel) which the parabolic reflector surface intercepts from the satellite.



BACKYARD OF THE FUTURE? This home designed and assembled all aluminum antenna cost the builder around $600 in materials and perhaps 30 hours of time [a 16 footer].

LNA PLUS FEEDHORN - The flared object in front is the LNA feed, behind it [rectangle] is the commercial [SCI] LNA and behind that a special mount for remote polarization switching of the antenna.



Between the LNA and the receiver (which typically mounts inside) is a special type of coaxial cable designed to transport the microwave frequencies in use for this service. This cable is known by various trade names including Heliax® and it is 1/2 inch or 7/8 inch in diameter; the size a function of the efficiency of the coaxial line (bigger lines lose less signal between the LNA and the receiver; all coaxial cables 'lose' some measureable amount of satellite signal as they carry the signal to the receiver).

3) **The satellite receiver** - is basically a 'microwave frequency range' television receiver. This is not something you will find on display at your local Radio Shack (yet!), nor at your local TV shop (unless the TV shop operator is one of those new-breed dealers of this type of equipment). This very special receiver is currently being produced in quite small quantities (typically fewer than 800 such receivers per month for **all** of the companies in the US now building them). Sources for these receivers are found in the 'Sourcebook' section of this handbook, to the rear.

Unlike your present television receiver, this one does not have (1)a picture tube, or, (2)a speaker. On the surface that probably sounds like a very strange receiver indeed since you can't see the

picture or hear the sound with it! The modern satellite receiver has either two or three sets of 'output **jacks on it.** Here's how it works. The receiver selects the appropriate satellite transponder channel with a tuning knob; much like tuning your AM or FM radio. On the backside of the receiver is a series of jacks; on the super-deluxe commercial receivers one jack has sound (audio) and another jack has picture (video). Many of the newer 'home' receivers have a third jack which has both the sound **and** picture **together.**

If the receiver you have chosen has a special jack for picture and sound **combined**, you hook it directly to your (existing) television receiver; set the TV receiver to a single TV channel position (TV channel 3 or 4 is the most common) and simply turn on the TV receiver. You **change channels** from the satellite with the tuning knob **on the satellite receiver**; your TV receiver stays on the same (3 or 4) VHF channel.

Now if you have selected a satellite receiver that has only the 'video' and 'audio' output jacks (and again, this is the approach of virtually all 'commercial grade' receivers), before you can watch the picture and listen to the sound, you need another bit of electronics in the circuit.

4) **The TV modulator** - what you have coming out of the satellite receiver's video and audio jacks is something called 'baseband'. That is, 'raw' picture/video such as you would have coming directly from a TV camera and raw audio/sound such as you would have coming from a microphone. To turn this into something that your standard TV receiver can cope with you need a gadget called a 'TV modulator'.

A TV modulator is in truth a very simple, low-powered TV transmitter. The same kind the local TV stations use except all of the frills (and most of the expense) have been left out. It simply 'converts' baseband video and audio into a pattern which the standard TV receiver can tune-in. It has two **input** jacks (one for the video from the satellite receiver and one for the audio from the satellite receiver) and one **output** jack (which sends a TV signal to your TV set through a short length of inter-connecting cable).

5) **The TV receiver** - in your home becomes the final link in the system. Whether it is connected to the satellite TV receiver that has a jack on it for direct connection to the TV receiver, or it is connected to the satellite receiver through the TV modulator, once connected it operates in a normal manner. Except of course as noted you switch or change satellite TV channels with the tuning knob on the satellite receiver, not the channel selector knob on the TV set.

Does this sound like a great deal of equipment 'just to watch television'? Perhaps. However, the total skills required and yes the expense has become much more manageable over the past couple of years. We'll talk

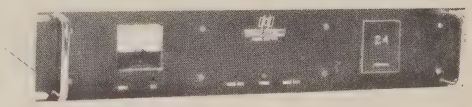
about this shortly.

WHAT CAN YOU SEE?

All of the equipment in the world is not good for much except display on a shelf unless there is something up there to receive and watch. It turns out there is more television available via satellite than from any other 'single source' and the amount of programming grows every month; some months, every day!

With the minor exception of the Russian INTER-SPUTNIK satellites, all of the birds we shall discuss operate in the **same** frequency band. A logical question might be ''Since all of these satellites are located up there in space, what determines which satellite you are tuned into, and what keeps one from interfering with the others?''.

The antenna is the answer. That parabolic shaped 'dish' antenna requires quite precise alignment to 'find' the satellite of interest; in other words, it must point dead-at the satellite or it won't pick up the satellite's signals. Now by international accord the satellites are 'stacked' or arranged along the mythical geostationary/Clarke orbit belt in increments of 4 to 5 degrees of longitude. In fact satellite locations in all of the literature are located by their longitudinal 'parking spot'. In the satellite world, as in the map making world, 0 degrees longitude is that north-south line that runs from the north pole to the south pole through Greenwich, England. Everything west (i.e. towards North America) is defined in degrees of longitude 'west' and everything east is defined in degrees of longitude 'east'.



HIGH DOLLAR - single channel commercial unit from Microdyne carried $3,000 range price tag when first introduced. Subsequent price erosion of commercial gear has followed.

If the satellite of interest is parked directly above the equator, 22,300 miles up, at a location of 135 degrees west, we know where to point our antenna. How? By determining where in the sky 135 degrees west and 22,300 miles 'up' is! This is why some antennas have two separate adjustments for pointing the parabola; one that adjusts the left and right or east/west movement (called azimuth in the trade) and one for pointing up and down (called elevation).

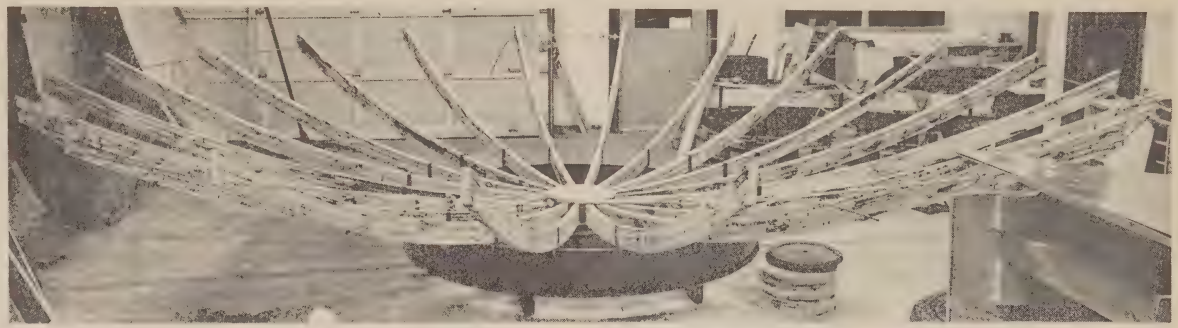
By international accord the satellites are 'spaced' along the geostationary/Clarke orbit line (belt) every 4 to 5 degrees when there are multiple satellites in one area of the world. Now when satellites are spaced, in space, 4 to 5 degrees apart in longitude, when you point your parabolic antenna at one satellite the 'beamwidth' or directivity of the parabolic antenna is so sharp or keen that it 'sees' **only that one satellite** you are pointing at; no others. And that explains how you can watch one satellite's transponder channels, move the antenna

(slightly) to pick up the next satellite to the left (or right) and watch an entirely different (new) set of transponder channels.

Several sources for obtaining 'pointing information' (i.e. where in the sky to point your antenna in degrees of azimuth - assuming north is 0 degrees - and elevation) are listed in the 'Sourcebook' section to the rear.

Now what can you see? Remember that the satellites are simply relay stations in space; whatever goes into the satellite from the uplink comes out on the downlink. Perhaps the best way to picture the satellite system's operation is to think about a bus line or truck freight company. The satellite operators (Western Union, RCA, ATT/GT&E, Canada's TeleSat and the international INTELSAT) are simply bus/truck operators. They are required by various national and international rules and regulations to 'carry' (i.e. relay) anything brought to them. They charge a fee for use of their 'bus/truck'; a fee that is based upon how much 'traffic' there is for the bird, how often the 'traveler' travels and so on.

Anyone (or any company or even any nation) that has communications 'traffic' can avail themselves of this carrier's service. Satellites are seldom dedicated for a

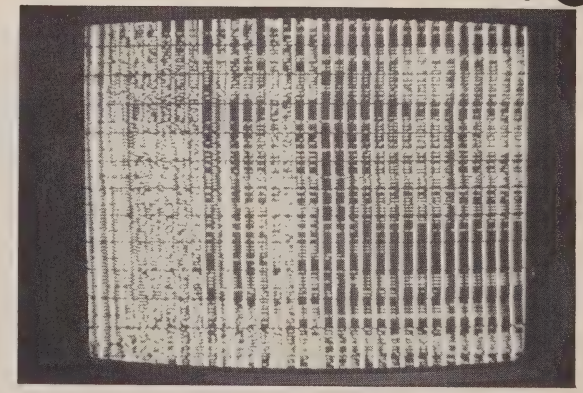


PARAFRAME'S JIM VINES pioneered use of laminated layers of wood to form [under stress] the precise curvature required for the parabolic surface.

single purpose; that is, the same satellite may carry television programming on one channel/transponder, telephone messages on another channel/transponder, computer to computer data communications on yet another channel/transponder and so on. In fact, as you tune through all of the channels on a particular satellite you will discover that in most cases you alternate between television pictures (and sound) and a strange fuzzy looking pattern that is on occasion accompanied by a low 'rumbling' noise. The latter format is simply a transponder being used for telephone, computer/data traffic; such traffic produces no 'picture' on the screen and to decipher it requires a special adapter added to your basic satellite receiver.

Back to our bus/truck line analogy. Anyone who **purchases** a ticket to ride on a bus can ride along. In plain view of everyone else on the bus. Anyone who wishes to ship a package via a truck freight company can get his package delivered, although the content of the package may not be known by the trucking company. Satellite service is similar to both examples.

There are many different types of users of television relay via satellite. Each has a special reason for being 'on the bird'. The television networks, for example, presently utilize satellite relay as a means of transmitting a distant event (such as a sporting meet) from the place where it is being held back to the network's control center in say New York or Los Angeles. Utilizing a transportable (i.e. trailer installed) uplink terminal perhaps at the stadium of the event, the



NOT MUCH TO SEE - This Reuter's 'digital' signal is a strange moving checkerboard but hidden inside, requiring a special adapter, is the latest world news, stock and commodity market reports!

pictures and sound narrative of the event are sent via a satellite channel to the network operations center. There the game/event is either taped for later play on the 'terrestrial network', or it is 'edited' for live distribution on the 'terrestrial' network. In either case this particular satellite relayed event is at that moment considered by the network to be their **private**, personal property. Simply because it has not been put into final 'public' form (i.e. commercials, other editing and commentary is

added at the network control center before releasing the program to the network proper and the 'terrestrial' stations). The network utilizing satellite relay for this purpose is really doing nothing more than making use of the low-cost relay service of the satellite at this point; it is not 'broadcasting' the event via satellite as it were.

Meanwhile up in Canada the ANIK satellite(s) use the bird for another reason; to distribute the **actual network programming** from Toronto/Vancouver/Montreal (et al) directly to the TV stations located throughout northern Canada. The programming sent via ANIK satellites is the same programming people watching their local terrestrial TV station see, via their rabbit ear antennas. The satellite is a distribution system for the full and complete network 'day'. In a definition sense, this 'programming' is not private; it has been edited and polished for direct public consumption.

Returning to the United States, on the SATCOM FIII satellite and on the COMSTAR D2 satellite we have approximately 30 transponder channels dedicated to the relay of television programs for cable television systems. Here a long list of programmers (HBO, SHOWTIME, Nickelodeon, PTL, WTBS, WOR and many more) purchase a 'ticket' on the 'satellite bus' to get their programs from their own control centers to the 5,000 or so cable television systems now equipped with satellite receiving terminals (TVROs). Most of these cable-oriented programmers have a contractural arrangement with the cable systems whereby the cable systems pay some fee per cable system customer. These fees vary from nothing per home per month to as much as $20.00 or so per home per month.

While over on the INTELSAT satellites we have customers leasing or renting transponder 'time' to send television communications between such places as London and New York (i.e. network news reports which are edited and polished up from their raw form as received via INTELSAT and then later shown on say the network evening news), or in the case of Brazil, from a control center in Sao Paulo through the satellite to a network of terrestrial TV stations just as Canada utilizes its ANIK birds.

Remember the bus or truck freight line? Basically a bus cannot refuse to transport a person from point A to point B if the person is willing to pay the fee. A trucking company has the same obligation for packages; this is the way something called 'common carriers' work. They are licensed to operate for their stated purpose, their fees or rates are approved by some governing body and they cannot discriminate against or between users. Another way to state this is that they rent 'space' for transportation; but they have no ownership rights to whatever it is that occupies that 'space'.

The satellite 'common carriers' have the same type of regulation governing their operations. They do-not (with very few exceptions) own or control what is transmitted by them; the 'programming material' belongs to the user or at least the user of the satellite relay has some legal right to the programming he is

transmitting.

WHAT CAN YOU DO WITH...

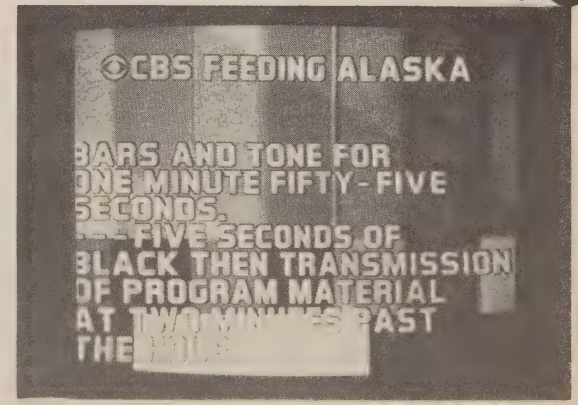
...what you see? Ahh yes, now we are into the paramount legal question of the day. How's that?

Well, under US FCC (Federal Communications Commission) rules, and similar international rules, all common carrier services are considered private transmissions. Private? Well, that means someone owns the rights to the television programming, and that someone has the legal right to (1) **set a fee** for watching/using the programming, and, (2) in some instances even **refuse** to allow people to use that program if they wish.

Confusing? It is because you and I have grown up accustomed to being able to walk into a store and plunk down dollars for an AM or FM radio receiver, or a television receiver, take the unit home and hook it up and tune in anything we can hear or see. **Without paying a fee to do so.** We have this ability because the FCC (and other international bodies) recognized way back in the late 20's and early 30's that the public owns the 'airwaves' and the public has a right to service from these airwaves. In effect, 'broadcasting is free'.

Only by legal definition **satellite transmissions are not broadcasts.** That is, they are not considered by definition to be broadcasting stations or services; they are considered to be private services.

If this is clear to you (even though you may not like the sound of it!) the way this legal definition impacts upon your 'right' to receive satellite TV transmissions may not be so clear.



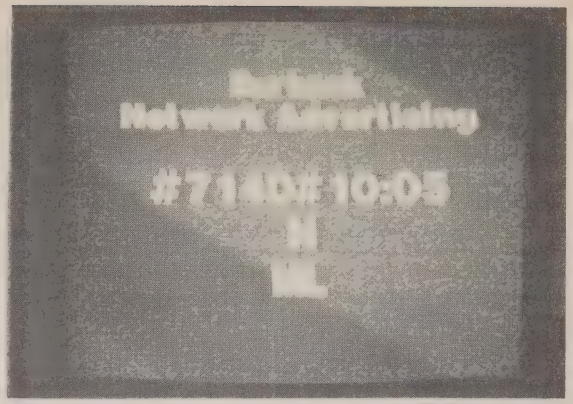
ALASKA HAS A BIG MOUTH - and CBS [plus others] attempt to feed it' via satellite. Programming is sent to Alaska daily on SATCOM FII transponder 1 and 23 and delayed broadcast in the largest state.

1) Remember that the satellite 'mixes' various kinds of users on various transponder channels. For example, there may be a no-fee religious satellite programmer on one transponder of a given satellite while 'right next door' on the adjacent transponder channel we have a 'private' network feed of

a baseball game. What is to prevent someone who has the clear written authority of the no-fee religious programmer to watch his service from tuning in the dial to the next transponder channel and watching the baseball game which he has no authority to watch?

Nothing other than the conscience of the viewer.

Obviously this type of 'mixed' satellite use, and the fact that anyone equipped with a satellite terminal as described in this Handbook is 'free' (in the sense of having the **ability** to do so) to tune in anything 'in the sky', is bothersome to some users. Not very long ago the RCA folks were mixing various classes of users on the same transponder at various times of the day. For example, a premium (pay TV) movie service that operated on transponder 16 of SATCOM FI (a service then known as FANFARE) would transmit movies and sporting events, for a fee, to cable systems from around 6 PM to midnight daily. RCA, mindful that this transponder was not in use by FANFARE prior to 6 PM, decided one day to use this transponder to send the ABC evening news feed from Chicago and news hawk Max Elliott. ABC would turn on their cameras and start the feed around 4 PM daily and for the next hour or so Max Elliott and the Chicago ABC crew would go about their business in their Chicago studio preparing and arranging the day's news. Being typical news people, and not being mindful that their actions were being transmitted via satellite back to New York (as well as over the whole United States, Canada et al) they said and



ADVERTISING VIA SATELLITE - latest trend is for advertising agencies and networks to pre-feed groups of commercials via satellite to affiliated TV stations. Back to back commercials!

did things which you never saw them do on the evening newscast!

Some of the cable firms connected to the FANFARE 'feed' had not bothered to 'turn off' the satellite service and there in Grandma Jones' living room was ABC newscaster Max Elliott saying unusual four letter words and overseeing an office intra-mural track meet featuring a couple of female secretaries and a couple of

male news people. Needless to say RCA quit 'stacking' the so-called 'private' transmissions and the 'cable program feeds' on the **same** transponder shortly after this happened!

(Max and his crew continue to cavort weekdays on another satellite channel just in case you are intrigued by such goings on; in fact, virtually all of the evening newscasts found on the networks are similarly relayed via satellite.)

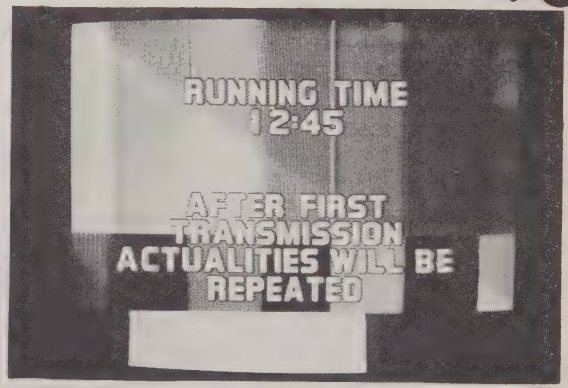
ABC considered their Chicago/New York transmission private; they raised cain with RCA for allowing anyone other than New York to 'see' the transmission. But the example of what can happen is a good one.

If **some** transmissions are private, what about the others?

Well, there are several categories. Let's see what that is all about.

1) **Purely Private** - intended for one or more specified recipients, containing material which is protected by something called Section 605 of the Communications Act from unauthorized 'interception' and 'divulgence'. This can be a satellite TV program feed, a private telephone message (**all** telephone messages are considered private), or a computer 'talking' to another computer. YES - with the proper equipment anyone can 'eavesdrop' on these transmissions; but you are not supposed to, and if caught doing so you can be liable for both criminal sanctions and potential monetary fines.

2) **Almost Private** - transmissions for which people pay a fee to receive and use. Included in this batch are Home Box Office (HBO) which presently leases four transponder channels on SATCOM FIII and two on COMSTAR D2, SHOWTIME which leases four transponders on FIII and one of D2, (Warner/Amex's) The MOVIE CHANNEL which currently uses three transponders on FIII and has a fourth on D2, the Entertainment and Sports Programming Network (ESPN) which has one trans-



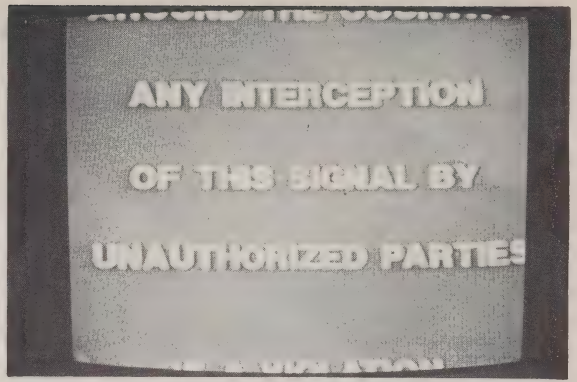
NEWS FEEDS - network and independent news feeds, raw from the field and prior to network 'editing', are transmitted daily for hours on end in 4 PM to 7 PM [eastern] time slot on many satellites.

ponder on both FIII and D2, USA Network on FIII transponder 9, and the Satellite Program Network which has one FIII transponder and a hold on a second on D2.

These services are intended for cable systems which **contract** for the satellite feed, and then in turn **re-sell the programming** service to their cable subscribers. Nobody not authorized to watch these channels is **supposed** to do so. In fact thousands do.

Because of contractural limits between say HBO and movie producers such as 20th Century Fox, HBO is precluded (at the moment) from authorizing an individual home terminal for tuning in its satellite transmissions. Why? Simply because HBO and SHOWTIME **say** their film-rental contracts with their various program suppliers (HBO and SHOWTIME largely rent films for their programming use) only allow HBO and SHOWTIME to re-sell the movies to homes **that are connected to cable systems**; not to private terminals not connected to cable systems. Thus even if you were pre-disposed to pay the annual HBO and SHOWTIME fee (typically $96 to $120.00 per year at the cable-retail rate), neither HBO nor SHOWTIME can today **accept** your money.

SPN says it has similar use-rights 'problems' and it too refuses to **authorize** private viewers to use its signals; although here there is a 'twist' to the scenario since cable firms carrying SPN do so free of charge; there are no fees involved, since SPN is primarily 'advertiser supported'.



LATEST IN WARNINGS - this service let's you know that if you don't have their permission to view [ESPN on transponder 7], it is their contention you are 'violating' their rights.

ESPN and (the) MOVIE CHANNEL are more realistic about the situation and **both accept** fees (MOVIE CHANNEL - $96 **per year**; ESPN $100 **lifetime** fee). A listing of who to contact where for viewing permission appears in the 'Sourcebook' section.

3)**Private But Willing** - There are additional 'private' services on the satellite who **are willing** to grant permission for private viewing, **and at no fee.** These include PTL (People That

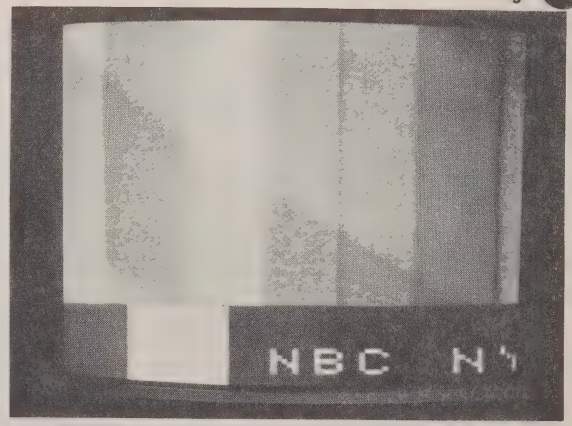
Love, a 24 hour per day religious operation on transponder 2 of FIII, CBN (Christian Broadcasting Netowrk, another 24 hour per day religious system on transponder 8 of FIII), and Trinity Broadcasting Network (yet a third religious broadcaster operating 24 hours per day on FIII transponder 13). All it takes to get their permission to view is to write a letter requesting same (again, see "Sourcebook" section).

4) **Public, But Private** - And then there is the strange situation presented by the 'super stations', those non-network (i.e. independent) TV stations that are available via satellite for a modest fee to cable systems to in turn 're-sell' to their subscribers.

Chicago's WGN (transponder 3, FIII, Atlanta's WTBS (transponder 6, FIII and New York's WOR (transpodner 17, FIII are real TV broadcast signals relayed to satellite just as local viewers in their areas of direct 'terrestrial' reception see the station. The stations **themselves** do not contract for satellite 'time' rather it is done by a middle-man company called a re-sale Common Carrier. The Common Carrier firms pay the cost of the satellite and the uplink costs and in turn charge the cable firms from 6 to 10 cents per home per month.

There is an argument that cable firms which re-sell these services should pay for the satellite delivery **since they** are indeed **making money** with the satellite delivered channels. BUT - the argument goes, since these are off-the-air broadcast signals intended for public reception without a fee, the private home terminal viewer should not be charged since he is merely 'an extension' of the direct viewing public located in the area served by the terrestrial station itself.

The Common Carrier firms who bring these services to the satellite are at this writing divided on how



INSIDE NBC - Networks often utilize satellites to feed events out to affiliates for a 'closed circuit preview' session, as well as using same satellite to receive events from the field.

to handle private terminal viewers. The Common Carrier bringing up WTBS flatly refuses to authorize (even for a fee) private terminal reception. The two carriers bringing up WGN And WOR are more willing to deal with private terminal viewers but rather than charging the ten cents per home per month fee they ask $60 per year, in advance, for permission to view. The bottom line is that few actually pay for the service on a private level.

Well now, this all seems pretty confusing! It is.

That is one of the reasons why satellite private terminal operators have formed their own 'trade association'; a group of individuals operating with a Washington, D.C. office and attorney to attempt to find legal answers to these questions. The group (**SPACE** - see 'Sourcebook' section) hopes to find acceptable legal answers to these questions and to establish a framework by which private individuals can be an accepted part of the national service without the fear of violating somebody's rights.

THE FCC IN ALL OF THIS...

Way back in 1975 the FCC, in deciding that cable firms **could** own commercial (but private in the sense of non-government) satellite terminals, ruled that all such terminals had to be 'licensed'. This was in keeping with the FCC's long ago adopted policy that all 'microwave systems' had to have licenses for both the

'THE' MOVIE CHANNEL - is actually 'one' of approximately 9 such services; was first to go to a 24 hour satellite telecasting day with movies all day and all night long.

transmitter (in this case the uplink **and** the satellite itself), and, for all receivers associated with the system. This situation prevailed until October 18, 1979 when the Commission again ruled on the matter; this time making licensing to receive satellite signals (any kind, including both radio and television) optional.

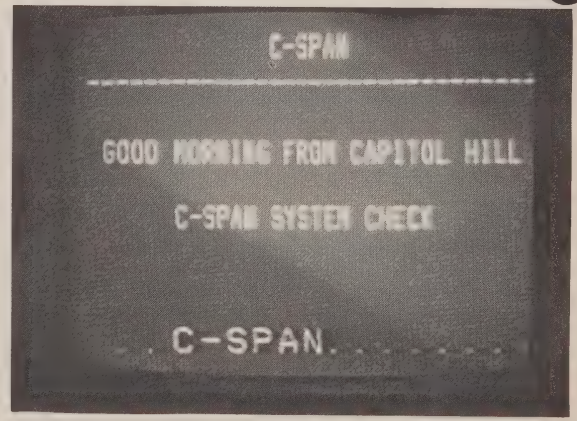
So at the moment **you need no type of federal license whatsoever** to build a TVRO. YES - you **can** get a license

if you wish but it seems like a needless expense (typically $1200 to $1500) and while this procedure offers you a certain amount of protection against 'interference' in the future, it is not a solid guarantee of anything.

The decision to do away with mandatory licensing was an important one. It meant that the government's involvement in satellite reception was minimized. However it did not address the question of 'privacy' of satellite communications.

If the users and would-be-users of private satellite terminals are in a quandry over what they can and cannot do legally, there is no clearer interpretation **from** the FCC. Presently a task force, possibly working on a1982 type time frame before completion, is attempting to sort out the **real meaning** of the present (adopted in 1934) rules and to reach some common sense position for re-directing this regulation in the future. The 1934 law is known as 'The Communications Act of 1934' and it was written long before satellites were thought up by Arthur C. Clarke. It talks about 'private transmissions' but does so in the context of a telephone company employee, for example, setting out to deliberately 'eavesdrop' on a private telephone conversation; and then to pass what he overhead onto a third party or to attempt to 'profit' from his eavesdropping. The matter of 'eavesdropping' on privately owned (but publically distributed) television programming such as HBO, or the re-distribution of public broadcast signals such as WTBS is no place discussed.

The present FCC position is one of (1) they are



INSIDE CAPITOL HILL - The C-SPAN coverage of the U.S. House of Representatives [transponder 9, FI] brings the American public into the political activities in Washington daily.

studying it, and, (2) they **hope** 'the marketplace' will resolve these problems. In the meantime the marketplace **is trying** to do just that and whereas in mid-1979 there were only two firms manufacturing and selling satellite television equipment to **private** individuals, today there are dozens manufacturing it and hundreds re-selling it as dealers and distributors. And pending

resolution of the 'problems' stated here, hardly anybody pays any attention within the home to the 'restrictions to viewing private material' although manufacturers, dealers and distributors are usually very careful about what they say or print regarding this subject.

THE SAFE THING TO DO?

Be cool. If you are a prospective individual home viewer, look into obtaining 'letters of permission to view' from one or more of the firms listed in the 'Sourcebook' section. Having a letter or two at home in your file is your 'moral justification' for having that dish antenna out in your yard. Don't do anything foolish, such as charge neighbors to view your programming or invite 'strangers' into your home to see what you can get. The stranger may be out to construct a 'test case' for willful violation of whatever it is the present rules can be interpreted to mean.

NOW - if you harbor thoughts of dealing in or distributing low-cost satellite receive terminals (hundreds of new businesses have been formed in this area of commerce during the past year), the path is clearer for you.

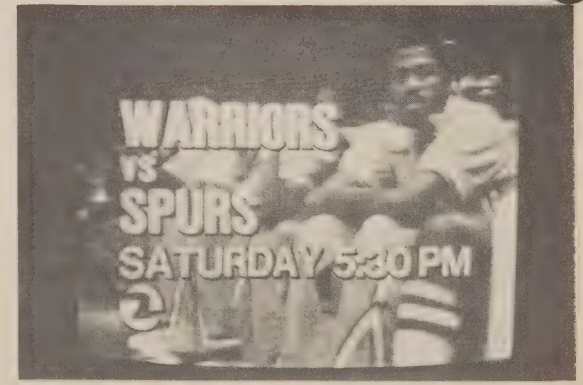
1) You can sell a terminal **to virtually any public gathering spot** (motel, hotel, even an apartment house/condominium, bar, club, restaurant, golf course, etc.) **and** they can in turn (with or without your help) get official permission to show in their establishment **virtually any of the services** listed here. Hotels in Las Vegas and Reno now routinely offer ESPN (the Entertainment and Sports Programming Network) for example, received by their own private earth terminals; distributing the ESPN (24 hour a day sports) programming to motel/hotel rooms. Several hundred motels (Holiday Inns, Ramada Inns, many independents) now have their own earth terminals and they offer a 'selection' of satellite programming to their rooms including the premium services such as HBO and SHOWTIME; **by contract and with full legality.**

2) A brand new service which began mid-1980

SIN VIA SATELLITE - Spanish International Network began operations on WESTAR II, is now expanding to WESTAR III with feeds up to 12 hours per day of Spanish language broadcast television.

provides approximately 8 hours per day of in office/home professional training for doctors, nurses, real estate agents, etc. on a 'continuing education' basis. This new accredited via-satellite service will be a tremendous 'marketing tool' for dealers and distributors who wish to sell private terminals to professional people since the continuing education service meets or exceeds each state's educational requirements for professional up-dating.

As strange as it all may sound, the **unresolved** area is in the **single viewing home** system which neither fits the 'CATV system' definition nor does it qualify as a 'commercial establishment'. There **is** one answer to this; connecting up several neighbors and operating as a 'mini-cable TV system' as we shall shortly see.



LOTS OF SPORTS - A private satellite terminal owner can probably find an average of 30+ hours of sporting events every day on satellite!

THE TERMINAL EQUIPMENT

Having been bitten by the lure of the satellite TV bug, for whatever reason and for whatever intent and purpose, let's see just what equipment is really required, what it may cost you, and where you go to get it.

In mid-1979, the only commercial equipment available in this field was that manufactured for the cable television, broadcaster users. These users don't think very long about spending upwards of $12,000 for a single receiver TVRO and many spend twice that much. The equipment suppliers obliged by keeping prices high and equipment loaded down with bells and whistles which somehow (they felt) justified the high prices.

Then in August of 1979 the Coopers held the first 'Satellite Private Terminal Seminar' and an overflow crowd of more than 500 people came from all over the world to attend three days of seminar rich in the nitty-gritty of what it **really takes** to construct or own or operate a truly low cost satellite TV terminal. Rising to

the occasion, a handful of pioneering small equipment suppliers appeared at SPTS '79 to display their new antennas and receivers. If you walked around the modest exhibit hall and looked for the lowest prices on antennas, LNAs and receivers, you came to the conclusion that for $3995 of your money and perhaps 15 hours of your time you too would have satellite TV in your home. AND - this was with commercially manufactured equipment.

At the same SPTS STT introduced the first in what has grown into a considerable family of do-it-yourself satellite TV construction manuals. One manual, penned by Stanford University professor Taylor Howard, described a complete receiver and LNA which Howard put together for under $1,000. The antenna had to be added to that. A second manual reported on the work of a South Carolinian, Robert Coleman, and it described Coleman's work buying up old, discarded (as in 'surplus') microwave and scrap electronic hardware and converting it to receive satellite TV signals. Coleman spent around $500 for his first operating terminal.

And so it all began. From a handful of innovators like Coleman and Howard a whole generation of 'satellite pioneers' walked away from SPTS '79 in Oklahoma City convinced that they too could build or assemble their own backyard terminals for between $1,000 and $2,000. And hundreds did so in the fall and winter months of 1979(80).

In just four years, from the first cable installation in September of 1975 to the summer of 1979, prices for commercial terminals had dropped from $125,000 to under $4,000; and here were walking, talking examples in the person of Coleman and Howard telling enthusiasts

READY TO ROLL - This Reno, Nevada distributor of private satellite terminals, like hundreds of others, "rolls' up to a customer's doorstep with a trailer-mounted demonstration terminal!

that if they **really** wanted to do it 'cheap', roll up their sleeves and go to work they could build a terminal for between $1,000 and $2,000!

Do all of these people receive high quality television pictures? Not necessarily, and you need to understand why.

There are at least four categories of people swept up by this technology movement. They include:

1) **The technologist** - a person who has some technical and/or mechanical skills, who is personally challenged to do it; to build his own terminal. To him (or her!) the pictures and the sound to be received are of secondary interest. Doing it, meeting the challenge and winning, that's where the adrenalin flows. Such an individual may never achieve 'perfect' or high quality reception; he may in fact never or seldom actually watch the programming. In fact, he may even lose interest and move onto some other project once the challenge is met.

2) **The dis-enfranchised viewer** is a person or family located in the wilds where no television reception exists (or TV is very poor quality). To this person, whether he or she lives in Canada's northern wilds or in the middle of a West Kansas ranch, satellite television is the first 'real' television to come along. They perceive the news, the sports, and yes the entertainment to be important to their lives and for this reason they are installing a private terminal. They may build it, or some parts of it, or they may buy it. But in the end, they'll watch it.

3) **The status-seeker** probably has plenty of television to begin with. He may subscribe to a local cable company, live in the suburbs, possibly owns a video tape recorder or two and to this individual satellite TV is the 'ultimate TV trip'; the wildest of the wild. They'll buy it, watch it, and most of all they'll show it off to their friends and neighbors. And every second sentence they utter will start off with "...Do you know what I saw on 'the Bird' last night...".

4) **The commercial user** sees money in having satellite TV in his place of business. In a sense, he is looking for an 'edge' on the competition, a way to offer something the competitor does not offer. A movie channel or two, ESPN, perhaps WTBS... they are simply new items to put into stock and sell.

One 'measure' of how good the reception should be will be found by the type of installation. A technologist may be proud of his reception, since he created it with his own two hands, a soldering iron and a bag full of parts. But if you are a status-seeker, you probably wouldn't want it in your home. Here is a basic rule of thumb:

If the terminal you see in operation was constructed by the owner, chances are it works less well **than a commercial one. If the pictures** are superb**, the guy who built it is no dummy and he ought to quit his**

present job and get involved in building terminals for a living; there is a huge market out there waiting to be filled! If the terminal you see in operation uses commercial equipment **[antenna, LNA and receiver], and the pictures are** not superb, **we'd suggest you double check** why **before you spend money with the** same **supplier. There is almost** no excuse **for poor pictures with commercial equipment.**

Almost no excuse? What does that mean?

Let's start with the basics of designing a terminal; in lay terms of course because you aren't expected to be an engineer here. In an earlier section of this Handbook we discussed the contour or 'coverage' maps as they appear on the backside of the **Worldwide Communications Satellites Wallchart**. Now let's apply some practice to the theory behind those maps. Engineers at RCA, Western Union, TeleSat (ANIK) and ATT/GT&E provide these maps to the FCC when the respective firms initially request FCC permission to 'launch' a satellite. These are the signal strength levels these engineers **forecast** for their respective satellite over various portions of their intended coverage areas. As a rule of thumb:

1) If your location on the map indicates you can expect to have 35, 36 or 37 dBw (dBw - that's a measurement of satellite transmission power) of signal in your area for the satellite (and transponders) you wish to receive, this means that you can select a parabolic antenna as small as ten feet

PIONEER COLEMAN - With his 10 foot 'surplus' parabolic dish antenna and re-built surplus equipment [on ground in foreground] was the first to demonstrate an "under $500" system.

in diameter and add to that a high-grade LNA and a good quality commercial receiver and produce perfect (i.e. no blemishes) pictures in your home.

NOW - as the signal contours become weaker (i.e.

say 32 or 33 dBw) there is only one way to **still** get a perfect picture with a high-grade LNA and a good quality commercial receiver; and that is to graduate to a larger antenna (remember **the larger** the antenna is, **the more** signal it picks up; another way of saying that if the signal level is 'down' in your portion of North America, you can build it back up by graduating to a larger sized dish antenna.).

RULES of thumb are dangerous but we'll supply you with some none the less. Check the EIRP (dBw) contour maps on the Wallchart, find your location, and, then look at what follows:

Signal Contour	Antenna Size Required [*]
35/36/37 dBw	10-11 foot
33/34 dBw	13-15 foot
31/32 dBw	16-20 foot
29/30 dBw	20-24 foot
27/28 dBw	24-30 foot
25/26 dBw	30 foot +

And an explantion for the asterisk [*]. This assumes you have purchased a high quality (120 degree - we'll explain that shortly) LNA, a good quality commercial receiver **and** (and here's the kicker) you want the pictures to be so darned good that your neighbors and family will constantly rave about them! In short, these will be true commercial-quality pictures with no blemishes; ever.

This may be 'more picture' than you really need. You may well be satisfied with a 'good' picture, one with perhaps an occasional fleck or two (the ramdom bits of 'noise' one sees in the picture on 'marginal systems' are called ''sparklies'' in the trade). OK - here's another rule of thumb.

Signal Contour	Antenna Size Required [*]
36/37 dBw	8 foot
34/35 dBw	10 foot
32/33 dBw	13 foot
30/31 dBw	16 foot
28/29 dBw	20 foot
26/27 dBw	24 foot

In central (southern) Canada and in the very upper mid-west between Manitoba and Ontario's mid-lands, the signal from the **ANIK B** satellite **is strong enough** that a six foot antenna equipped with high quality electronics will produce a "perfect" picture. Why is that? Because this latest version of the ANIK satellites operates with not five watts of satellite transmission power but rather with

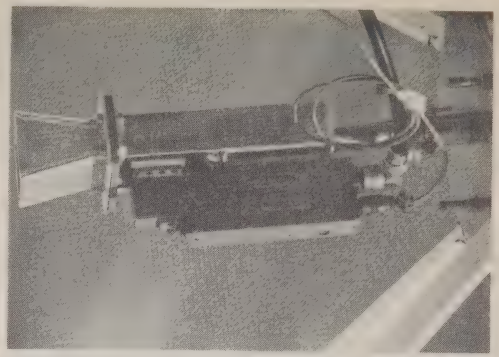
ten watts. And that 'doubling' of the power makes a big difference 'on the ground'.

If the Canadians have a ten watt satellite, can the US be far behind? No, not too far behind. When RCA launched their son-of-SATCOM III satellite (late fall in 1981) at least a few of the transponders on board (RCA says six) have approximately 8.5 watts of power and that makes a difference we can see and measure.

Many people get uptight over the antenna's size. Apparently they think a ten foot antenna is big; huge, too large for their yards. Agreed there are some locations where it may be. Yet we've seen people 'disguise' these antennas by calling them solar collectors (so even their neighbors don't know they are watching naughty satellite movies!) or covering them over with plastic geodesic domes such as you see advertised in the gardening magazines. Where there is a will...there is a way!

Now the Low Noise Amplifier (LNA). Remember this installs right at the antenna and its importance cannot be over emphasized. Today this remains the most space-age and sophisticated piece of equipment in the system. And also perhaps the most expensive.

An LNA is rated or graded by its noise contribution to the picture. In scientific circles an amplifier is tested or measured on a 'temperature scale' known as the **Kelvin** (K) scale. A **perfect** amplifier, one with no noise



LNA READY TO WORK - commercial [Amplica, Inc.] LNA installed on an H&R private antenna system. Note powering cable [smaller, top left] and coaxial cable [larger, under powering cable].

at all (noise is the enemy of a 'clean', noisefree picture) would have a noise factor of **0 degrees K**. Man has never built such an amplifier but he has come close; at perhaps $200,000 a copy! For those of us with less money to spend on the LNA, we have to settle for one in the 100 to 120 degree K class, which by present standards is pretty darned good.

The noise contribution of the LNA comes from the little microscopic transistors that amplify the signals, and the other small parts inside the unit. These

transistors are still quite expensive although their pricing has dropped dramatically (going into 1980 they were over $100 each; now they are closer to $30 each). Before these expensive transistors end up in an LNA they are graded on their own for their own noise factor; the really good ones naturally sell for more than the not so good ones.

Is the noise factor the **only** thing to consider with an LNA? No, there are two more things to consider:

1) **Gain** - the LNA is designed to produce a certain amount of 'gain', or signal amplification. More gain costs more money, of course, since more gain requires more of those reasonably expensive little transistors. So how much gain is the **minimum** amount you should have?

Gain is measured in units of something called decibels; abbreviated dBs. Most private terminals utilizing CATV quality commercial equipment specify LNAs with 50 dB or so of 'gain'. HOWEVER - the new breed of equipment manufacturers who have sprung to life to sell special receivers and antennas for the 'private' or home marketplace have relooked at this gain business in the LNA and they have **redesigned** many of the home/private **receivers** so that they work just fine with less LNA gain; say 33 to 35 dB of gain.

The big commercial systems still call for 50 dB, as do a few of the receiver suppliers to the private industry. Others however tell you quite frankly that you only need an LNA with 33-35 dB of gain and that saves you money (since gain costs money).

2) **Powering** - the LNA sits out there on the antenna. Attached to it, on the front and facing towards the concave reflector surface of the parabolic antenna, is a small horn-shaped device called (appropriately) the 'feed horn'. (The feed horn is like a conveyor belt; it picks up the satellite TV signal energy that is 'bounced' to it from the reflector surface and 'carries' it gently into the LNA where the amplification takes place.) The LNA must be powered; that is, it has to get operating power from someplace. The most traditional way to power it is to run a small weatherproof cable from inside at the receiver out to the LNA. This cable could carry an AC (alternating) voltage or a DC (direct) voltage. There are arguments which is the best to use (and LNA suppliers offer LNAs powered from either, but not both). One of the best arguments for powering from a **DC voltage** is that you have an extra measure of protection when there are thunderstorms in your area, with DC.

Having selected an antenna and LNA, the next task is selecting a cable to carry the antenna-received/LNA-amplified signals indoors to the receiver. This is not too difficult. All early installations went 'by the book' which means they believed the microwave engineers who told them one **has to use** a special cable known variously as Heliax® and other names. This cable is quite large (1/2 inch diameter to 7/8th's inch diameter), it is not very flexible (you can't bend it around corners) and it is

expensive; over $2.50 per foot these days.

Then it was discovered that if you have a relatively short cable run (40 foot or less with a 33-35 dB gain LNA or 100 feet or less with a 50 dB (+) LNA) that you could use a much less expensive, flexible cable known as RG-214/U. This stuff is still not cheap, but it is smaller and the 50 cent a foot price range (for small quantities) is far better than the expensive big stuff. The important thing to remember is that you can**not use** just any old piece of coaxial cable; the stuff sold for CB or even amateur radio use is definitely a no-no unless you are only going ten feet or so from the LNA to the receiver.

Which brings us to the receiver proper. My, how it has changed.

CATV grade commercial receivers still carry $3500 to $5500 price tags (for the 24 channel tuneable jobs). Not all cable firms want (believe it or not) receivers that tune **all** channels; many CATV installations literally 'dedicate' a receiver full time to a single satellite channel and once set into position it runs and runs and runs; always receiving **the same** satellite signal (transponder/channel).

Private or home receivers are totally tuneable. The theory is that a non-commercial user wants access to whatever is up there on the bird and having a tuneable

PIONEER HOWARD and his early-1980 packaging of his popular Howard Terminal receiver. Latest version in commercial manufacture has list price in $1350 region.

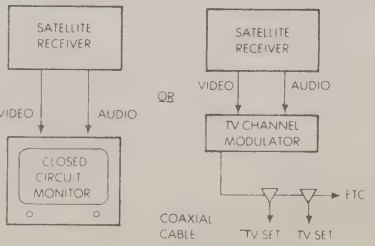
receiver makes this possible. Now receiver designs for private use are currently in a very desirable state of design evolution. Their pricing reflects this. You can spend as much as $2950 for a super-deluxe high performance 'private' tuneable receiver or as little as $995 for a stripped down, basic model. The super deluxe units have features such as automatic selection of both the vertical and horizontal (interleaved) transponders on SATCOM and COMSTAR, an easy-chair operable remote control to change transponder channels, automatic selection of just the right audio circuits when you (for example) switch between US and Canadian satellites (there is a small, perceptible change in audio quality between the US and Canadian satellites which the more elaborate receivers compensate for), extensive in-circuit metering devices that tell you how well the receiver is performing, and so on.

Perhaps the most important thing to know is that there are dozens of different receiver designs available now to the private terminal operator; whereas as recently as mid-1979 there was none yet on the market.

And the modulator. If the receiver provides you with a 'VHF television channel output' you simply run a piece of low-cost coaxial cable (RG-59/U) from the receiver VHF TV output to the input to your TV receiver. BUT - if your satellite receiver does not have a built-in modulator, you need an 'outboard' modulator box that will take the 'baseband' video and audio from the satellite receiver and convert it into a VHF TV signal which your standard TV receiver can tune-in.

Is there another option? Yes. A few very high quality installations connect the video output of the satellite receiver directly to a TV monitor. A monitor is a special studio type of 'receiver' that is usually built for TV production centers. Additionally, some of the newer projection TV systems also have a 'VCR' or 'baseband' input jack so you can plug your satellite receiver **directly into** such a TV. As you might guess, having high quality satellite TV displayed on a good quality projection TV system is just about the ultimate television experience!

PICTURE VIEWING OPTIONS



There is one commonly employed trick which gets you around having to purchase an outboard modulator if you already own (or are buying) a home VCR (video cassette recorder). Virtually every VCR has two input jacks on the back which allows you to plug in a portable

TV camera and a microphone to make home videotapes. These two jacks can be used to plug in respectively the video and audio output of the satellite TV receiver.

Inside of the VCR is a built-in modulator. It allows you to watch your tape recordings on say VHF channel 3 or 4 of your TV set. When you plug your satellite receiver video and audio into the VCR jacks you in effect are utilizing the **VCR built-in modulator** for your satellite receiver. And it works just fine too!

SHARING THE SATELLITE SERVICE

Regardless of your approach to a home terminal, there are some expenses involved. A cable system shares its TVRO terminal costs by taking the total cost and financing it over three to five years; and then 'charging' each cable subscriber a small amount per month for the services of the terminal.

Obviously sharing is a cost effective way to reduce the cost; if a terminal can be installed utilizing **commercial** equipment for under $3,000 (it can as 'Sourcebook' section shows) at this time, two homes sharing the service would have an equal investment of $1500. Three homes $1,000 each and so on.

Remember that until we send the satellite TV signals through our electronics and end up coming out of our (VHF TV) 'modulator' segment, we can't really view it on a standard TV receiver. This works to both your advantage and dis-advantage in sharing.

The advantage is that once you have the satellite signal(s) reduced to a VHF TV channel, you can (like the cable firm) simply run some low-cost (under ten cents a foot) RG-59/U or RG-11/U type cable from your home to a neighbor's home. A typical satellite TV receiver with a built-in modulator has sufficient 'power' to supply signal to up to six homes if they are within say 400 feet of your home. If you want to share signal further than that you have two choices; use a more powerful 'outboard' (i.e. external) modulator such as the CATV firms use (see 'Sourcebook' section) or go to the local electronic wholesale house and acquire for around $125 a 'line amplifier' which will boost the VHF TV signal sufficiently to allow you to send the signal through several thousand feet of low-cost cable.

What about videotaping the satellite programming and then sharing it with others? **Not** a very good idea for several **legal** reason. In a landmark legal case in the fall of 1979 a Federal District Judge in California ruled that home videotaping of **regular terrestrial TV signals** does not violate any rights the motion picture or program owner may have. In short, home video taping of terrestrial signals is OK. BUT - the same judge pointedly said that he was **not ruling** on the question of videotaping of subscription TV, cable TV premium (and by inference satellite TV) signals.

It is common knowledge that in some Canadian locations, as well as the United States, US satellite TV programming is being videotaped and is then being shown for a fee or sold to people who live where television reception is poor. A very lively busines (although probably illegal) exists in the South Florida area where HBO, SHOWTIME and other premium

services delivered via satellite are videotaped and then sent via daily jet to various Central and South American buyers.

The long and short of videotaping for fun is that if you do it in your own home and the tapes never leave your home, you are probably in little jeopardy. On the other hand, if you are videotaping to re-distribute the satellite materials for a fee to others, the chances are quite good that you will ultimately pay a substantial price (in legal fees and perhaps jail time) for your venture.

THE INTERNATIONAL FLAVOR

Earlier in this Handbook we touched on the operation of the internationally operated INTELSAT and INTERSPUTNIK satellites. To some people the opportunity to tune in 'live' television transmissions from England or Argentina is very exciting. Can **you** do it?

The INTELSAT satellites operate, as noted, for different purposes, than our domestic satellites. The largest portion of their television 'traffic' is something called occasional feed video. In other words, when an event requiring television coverage or satellite relay takes place, the event appears on the bird. When there are no such events, the birds either shut off or transmit 'test patterns'. Such events occur **when** they occur, and they are typically transmitted **when** they occur. That may be 6 PM in Tel-Aviv and 10 AM in Los Angeles. Such transmissions are timed not for the viewers (since in theory only network technicians are actually watching it via satellite) but for the event. Such events are sent typically live when they occur, but are taped for later ('more convenient') replay in the country where they will be shown.

Then there is the power level problem with INTELSAT. Because a high percentage of the INTELSAT fed video is intended for some network control center, and because it is uplinked by a massive 60-100 foot uplink antenna and is received by an antenna of the same size at the opposite end, INTELSAT purposefully 'turns down' the transmission power to just create a high quality picture with their massive antennas. This suggests, quite correctly, that small (home style) antennas probably won't produce much of a picture (if indeed any picture at all) during these transmissions.

HOWEVER - there is a different type of service now on INTELSAT and it is growing as a category each month. This is their program where INTELSAT 'rents' transponder space to various nations to conduct 'intra-nation' communications. When this type of INTELSAT use is employed, the signal levels transmitted are strong enough to produce reasonably good pictures on say a 16 foot size (or better if larger) antenna. INTELSAT calls this type of transmission pattern a 'hemispheric beam' and what they do here is to cut by 1/2 the area of the world they look at with their antenna system on the satellite. Rather than 'seeing' 40% of the globe at once, as is their usual format (they call this their 'global beam') they look at approximately

20%. By cutting the area covered in half, the signal levels on the ground area still covered get stronger.

A 'hemi' 26 dBw 'footprint' is, as noted, sufficiently strong that a 16 foot antenna equipped with a 120 degree K LNA and a modern receiver can receive quite enjoyable (although **not perfect**) pictures. The proof of this was demonstrated during the Miami, Florida Satellite Private Terminal Seminar in early February (1980) when the 500+ delegates were treated to an 'experiment' wherein direct INTELSAT reception originating in Sao Paulo, Brazil was tuned in.

AN EXCITED CROWD of perhaps 100 SPTS delegates gathered around equipment set up in the Bayfront Park Auditorium parking lot to witness the first small terminal reception from Brazil.

DIRECT FROM BRAZIL - "Rede Globo" as received on a [small] 15 foot terminal in Miami during SPTS '80 was the first INTELSAT reception for many hundreds attending the Satellite Seminar.

Brazil is a prime example. The Brazilian network's use of the INTELSAT relay is for the purpose of inter-connecting dozens of cities through Brazil to a central network transmission source. Thus the programming sent via 'BrasilSat' (that's what they call the service) is the regular network service seen throughout Brazil. Because it is operating on a hemispheric beam at a level of 26.5 dBw, a 16 foot antenna, 120 K LNA and appropriate receiver can tune in these transmissions

over virtually all of the eastern half of the US, parts of eastern Canada, throughout the Caribbean, virtually all of Central and South America! And the 'broadcast' day is around 18 hours long so it is no hit and miss proposition.

Perhaps you are not interested in INTELSAT, but live in Central America, the Caribbean, or South America. Can you 'tune-in' the popular American/Canadian satellites where you live?

Remember that the US/Canadian 'domestic' satellites utilize special directional antennas; designed to provide signal coverage just into the region of the world which they are 'licensed' to serve. On paper and in theory, this would preclude your being able to receive US programs in say Costa Rica. Fortunately the real-world of practice has shown us that the carefully constructed directional satellite transmitting antennas do not always work like their engineer-makers intended!

Following the Miami, Florida SPTS in early 1980, the approximately 100 'delegates' who came to Miami from the Caribbean, Central and South America went home to see what they could do. The results are still coming back and they look quite favorable.

1) **In Bermuda**, reports indicate 20 foot size antennas with a 120 K LNA and modern receiver will produce very high quality pictures on virtually all of the US/Canadian domestic satellites.

2) **In the Bahamas**, one terminal utilizing a relatively small 11 foot antenna with a 100 degree LNA (slightly more expensive than a 120) reports sparklie-free reception on five of the SATCOM FI transponders, slightly noisey pictures on the balance, and superb pictures from COMSTAR and WESTAR.

3) **Further southeast**, in the Dominican Republic, pioneers report a 13 foot antenna with a 120 degree LNA and appropriate receiver produces noisey-but-watchable pictures on SATCOM FI, and almost sparklie free pictures on COMSTAR. No report on WESTAR. Another installation there with a twenty foot antenna reports perfect pictures on all satellites.

4) **In Puerto Rico and the Virgin Islands**, it apparently takes a 20 foot (or larger) antenna for near-perfect pictures from SATCOM's FI although some COMSTAR channels are reported 'perfect' with 13 foot antennas.

Further east, into the Barbados and Trinidad region, reception from SATCOM FI and WESTAR should fall off rapidly although COMSTAR signals should still remain good on **some** transponder channels.

Results along the northern coast of South America are not encouraging. The only tests run to date have been with very large antennas (such as 30 to 35 foot in size) and while they have been successful (in locations such as Bogota, Columbia) there appears to be very little 'margin' left for smaller sized antennas.

5) **Due south from the United States**, through Mexico for example from approximately Mexico City **northward**, antennas in the 13 to 16 foot class

report good quality reception on virtually all of the satellites.

6) Further south there is sparse information available. In the Canal Zone, U.S. forces stationed there receive American live television via a local AFRTS transmitter that receives its satellite feeds on a 36 foot sized antenna. However, in Costa Rica (San Jose) an SPTS attendee who built his own 16 foot parabolic antenna (but used a commercial LNA and receiver) found excellent quality reception on one of the COMSTAR birds.

That the engineers who design the directional antennas for domestic satellites do not always 'hit their mark' squarely is well known. The Canadian ANIK-B satellite is a good example of this. Signals from this satellite (including two English language and one French language channel, programmed 'full time') are received with **almost** perfect pictures at least as far south as Miami and into the Bahamas on antennas as small as 13 feet. A twenty foot antenna in these areas would produce perfect pictures from this Canadian satellite although the Canadian operators of the ANIK system insist this is impossible!

NEWER, HIGHER FREQUENCY SATELLITES

Perhaps you have seen reports of an 'experimental Japanese' satellite TV terminal employing a cute little 2 or 3 or 4 foot antenna. You may have seen the report on PBS which showed this terminal sitting on a desk of a Washington FCC official, pointing out the window at a satellite 25,000 miles away. **NOW - wouldn't that be nice!**

The present satellite (TV) band of frequencies (3,700 to 4,200 MHz, downlink) have a 'capacity' problem. With satellites to be located no closer together than 4 degrees of longitude, and with each satellite having a maximum theoretical capacity of 24 transponder channels, there is some finite number of transponders which the geostationary/Clarke orbit belt can 'support'. One answer to this problem is for there to be a second (third, etc.) band or group of frequencies opened up. Since two satellites each operating on a different frequency band could in theory occupy the same spot in space (or , indeed, the same satellite 'housing') without interference, the effect would be to increase the capacity of the 'orbit belt' by adding new frequencies.

With an eye towards doing this, several experimental satellites have already been launched and tested. Operating in teh 11,700 to 12,200 MHz band these satellites have tested high power transmitters (up to 200 watts per satellite channel) and small receiving antennas (down to 18 inches across).

One US/Canadian test satellite was called CTS/Hermes. It is no longer operational, but when it was it allowed experiments such as looking through a window with a desk-top antenna. Another test is underway in Japan with a satellite called BSE. It has the capacity of only two channels and it is being utilized with antennas in the two foot class.

A third test, currently underway, involves the Canadian ANIK-B satellite which is equiped to transmit on **both** the familiar 3,700 to 4,200 MHz band **plus** the new higher 11,700 to 12,200 MHz band. Using the higher band portion of this bird, the Canadians have been experimenting with a maximum of three channels of television (relaying Vancouver's CBC outlet CBUT, CTV outlet CHAN and an educational television service). This is an experiment which may be dis-continued as early as the fall of 1982. **If it is discontinued,** the 100 or so 'test' receiving terminals spotted about the Canadian countryside by the ANIK-B authorities will be without television. Canada hopes to launch a full time service satellite (ANIK-C) utilizing this new, higher band in approximately 1983. If this schedule is met, this will be the first **regular** domestic satellite use of this new band.

In the interim, everything associated with this new higher band is experimental in nature. However at least one US source has begun importing receiver/LNA electronics from Japan for this band. This firm (see 'Sourcebook' section) sells the electronic portion of the terminals for around $3,000 in quantity of one; to that must be added the cost of an antenna (approximately $1,000).

BUT - you read that Japanese terminals will sell for as little as $300, complete? Well, perhaps someday when hundreds of thousands are being produced per year and they are as common as home VCR units now are. **But for now**, they are not cheap nor is there much logic going for purchasing one as long as the 'programming' available (on ANIK-B) is likely to disappear one day soon.

A FEW CAUTIOUS WORDS ABOUT EQUIPMENT PRICING

Like every new 'scientific marvel' satellite television has attracted its share of fly-by-nighters who would fleece anyone gullible enough to send money through the mails for a product they would offer for sale. Several individuals (or firms) have attempted, for example, to take advantage of the popularity of the original design work done by such pioneers as Taylor Howard and Robert Coleman; offering for sale ''Howard Terminal Receiver Kits'' or ''Coleman LNA Kits''. WHEN - in fact, neither Howard nor Coleman had any knowledge of such products and they certainly were not endorsing them!

We see antenna pricing settling down to the $800 to $1,500 range for various sizes from 10 to 13 feet. We also see the start of some innovative antenna **kits** (some as low as $475 FOB the manufacturer in Arkansas) coming along. There is this word of caution about antennas; in kit form or otherwise. Many antennas are priced **as the antenna alone**; that is, the mounting system and the antenna 'feed' (that small horn that attaches onto the LNA) are priced **separately**. When you are rounding up prices for antennas, be certain you understand **what** (if anything) **is not included** in the package price. Freight always comes extra and it can

amount to several hundred dollars; so ask, and be prepared!

LNA (low noise amplifier) **pricing remains high**; too high, in our judgement, to accurately reflect the recent gigantic reductions in the special (GaAs-FET) transistors which go into them. Retail prices for 120 degree K LNAs with 50 dB of gain are staying in the$500 to $700 region while the 30-35 dB gain units are between $950 and $1000. When a dealer or distributor purchases a quantity (say 25 and up) he may get 15-18% off of this level of 'user pricing' but the fact remains that even with today's technology the LNA seems overpriced to STT. Still, there is some comfort in the knowledge that the price was over $3,000 each just a couple of years ago!

The receivers are where all of the big action is at the moment. Receivers are going several directions at once. The more expensive receivers are adding new viewer-oriented features designed to make satellite viewing simpler and more enjoyable. The less expensive receivers are searching for less complicated techniques to provide the basic picture and sound. And the less expensive receivers are tooling up for large production quantities; one new receiver designed by Taylor Howard went into production with an initial order for 5,000 receivers in hand headed for a single (Australian) buyer!

We see the receiver market developing into both low, middle and high priced packages, over the next year

CONVOY - typical of the movies which end up on premium satellite channels, typically within 6-12 months of their first appearance in theaters.

to 18 months. Whereas $995 for a ready-to-plug-in receiver seems to be the lowest right now, it may drop another $100 or $200 from that point.

Because all of the equipment is such a fluid, ever-evolving thing right now we strongly suggest that **if you** are going to really get involved in this 'revolution in communications' that you at least send off for a 'Sample Copy' of a recent issue of [**Coop's**] **SATELLITE DIGEST**

(see 'Sourcebook' section) to see what is happening on a 'current' basis.

I WANT TO BUILD MY OWN...

There are several (STT) manuals now available which detail circuits and construction and alignment procedures for several different approaches to building your own system. Some people prefer to build their own antenna and perhaps construct a receiver from circuit boards or a kit. The Taylor Howard manual first distributed at SPTS '79 contains a very good, basic and adequate performing low noise amplifier.

At least one antenna "kit" is now available; others can be expected to follow if the first pioneer in this area does well with his product. LNA circuit boards, some with kits of parts (but lacking detailed construction or alignment instructions) are also available from several sources. Receivers are available as circuit boards (you supply the parts), circuit boards plus some of the hard to find parts, or as complete kits.

To date, the 'kits' are **not** up to the class of the popular 'Heathkits' (or Heathkit Manuals) however and anyone considering such a purchase should carefully investigate just how much background knowledge and test equipment is required before they fire off an order for several hundred dollars of anything.

QUESTIONS?

Satellite Television Technology is essentially a

Our construction / training manuals have become the basic "workbooks" for thousands of terminal builders and installers. And our monthly **CSD (Coop's SATELLITE DIGEST)** tends to be the "glue" that holds it all together month after month, change after change.

Additionally, STT sponsors several Satellite Private Terminal Seminars per year; scattered throughout the United States so as to give everyone the opportunity to attend one within reasonable distance of their home.

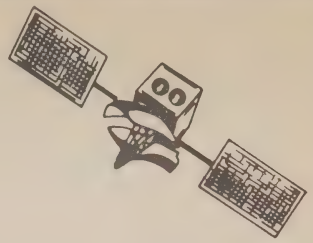
In spite of all of this (or perhaps because of all of this!), you have questions which you cannot locate answers for. How do you get help?

First - We do **not** recommend that you attempt to call Bob Cooper on the telephone; several hundred try each week and frankly very few get through to 'Coop'. However, you **can write** and **you will receive a response**; even if it is penned across the bottom of your original letter and returned to you.

Second - Check the sources listed in the following 'Sourcebook' section of this Handbook. There are plenty of knowledgeable people out there now who **can** answer your questions.

And we thank you for 'tuning in' this Handbook. We wish you every success in your own adventure with low cost private satellite terminals!!!

TVRO HANDBOOK 'SOURCEBOOK' SECTION



The purpose of this section of the Home Satellite TV Reception Handbook is to provide reliable sources for obtaining additional materials, information or equipment to implement your own private home satellite (TV) reception terminal. Because this is a very fast developing field there are sure to be new additions to this listing after it has been prepared and published. Updatings appear on a regular basis in the news columns of (Coop's) SATELLITE DIGEST.

PRIVATE TERMINAL EQUIPMENT

The following firms provide completed (i.e. wired and tested in the case of electronics, ready to install in the case of antennas) hardware for the private terminal industry.

ADM (ANTENNA DEVELOPMENT & MFG. CO.), P. O. Box 1178, Poplar Bluff, MO 63901 (antennas, complete systems).

ADVANCED ELECTRONICS, INC., 5085 S. Arville St., Las Vegas, NV 89118 (complete systems).

ALASKA MICROWAVE LABS, 4335 East 5th Ave., Anchorage, AK 99540 (TVRO parts, components).

AMPLICA, INC., 950 Lawrence Dr., Newbury Park, CA 91320 (LNA's).

ANIXTER-MARK, 5349 W. Fargo Ave., Akokie, IL 60076 (complete systems).

ARUNTA ENGINEERING CO., Box 15082, Phoenix, AZ 85060 (receivers, stereo tuners).

ATV RESEARCH, 13th & Broadway, Dakota City, NE 68731 (modulators).

AVANTEK, INC., 3175 Bowers Ave., San Jose, CA 95051 (LNA's).

AVCOM OF VIRGINIA, INC., 500 Research Rd., Richmond, VA 23236 (receivers, complete systems).

BIRDVIEW SATELLITE COMMUNICATIONS, INC., P. O. Box 963, Chanute, KS 66720 (complete systems).

CAYSON ELECTRONICS, Rt. 3, Box 160, Fulton, MS 38843 (antennas).

CHANNEL MASTER, Ellenville, NY 12428 (complete systems).

CHAPARRAL COMMUNICATIONS, P. O. Box 832, Los Altos, CA 94022 (feeds).

COLEMAN, ROBERT M., RFD 3, Box 58-A, Travelers Rest, SC 29690 (receivers, TVRO components).

COLUMBIA SATELLITE SYSTEMS, 2038 Congressional Blvd., St. Louis, MO 63141 (receivers, complete systems).

COMMUNICATION ENTERPRISES, 11196 Pleasant Valley Rd., Penn Valley, CA 95946 (complete systems).

COMTECH DATA CORPORATION, 613 S. Rockford Dr., Tempe, AZ 85281 (complete systems).

CRESCOMM INC., 10-B Washington Ave, Fairfield, NJ 07006 (TVRO wire & cable).

CVS SYSTEMS, INC., 314 N. Baldwin Ave., Marion, IN 46952 (complete systems).

DEEP SPACE COMMUNICATIONS, INC., Rt. 1, Box 351-A, Chancellor, AL 36316 (complete systems).

DELSTAR SYSTEMS INC., 7800 Bissonnet, Suite 200, Houston, TX 77074 (complete systems).

DEXCEL, INC., 2285-C Martin Ave., Santa Clara, CA 95050 (LNA's, Receivers).

EARTH TERMINALS, 255 Northland Blvd., Cincinnati, OH 45246 (receivers).

EASTRIDGE SATELLITE SYSTEMS, INC., P. O. Drawer O, Hwy 35 South, Charleston, MS 38921 (antennas).

ECHOSPHERE CORPORATION, 5315 S. Broadway, Littleton, CO 80120 (complete systems).

FRANK'S T.V. ANTENNA SERVICE, INC., 2059 Palos Verdes Dr. North, Lomita, CA 90717 (complete systems).

GHOST FIGHTERS TV ANTENNA SPECIALISTS, P. O. Box 8136, Missoula, MT 59807 (antennas).

GILLASPIE & ASSOCIATES, INC., 365 San Aleso Ave., Sunnyvale, CA 94086 (complete systems).

HAMILTON SATELLITE SYSTEMS, Box 36, Stearns, KY 42647 (antennas).

HASTINGS ANTENNA CO., 847 West 1st, Hastings, NE 68901 (antennas).

HEATH CO., Benton Harbor, MI 49022 (TVRO kits).

HERO COMUNICATIONS, 1783 West 32nd Place, Hialeah, FL 33012 (complete systems).

H & G SYSTEMS, 15109 Chicago Rd., Dolton, IL 60419 (receivers).

HIGH FRONTIER CORPORATION, 2230 E. Indian School Rd., Phoenix, AZ 85016 (complete systems).

HOME CABLE, INC., 2123 Lewis St., Salina, KS 67401 (antenna actuator kits).

HOOSIER ELECTRONICS, P. O. Box 3300, Terre Haute, IN 47803 (complete systems).

HOUSE OF AZTEC, 10424 Owl Circle, Fountain Valley, CA 92708 (complete systems).

INTERNATIONAL CRYSTAL MFG. CO., 10 North Lee, Oklahoma City, OK 73102 (receivers).

INTERNATIONAL SATELLITE SYSTEMS, P. O. Box 901, North Little Rock, AR 72115 (complete systems).

INTERNATIONAL VIDEO COMMUNICATIONS INC., 4005 Landski Dr., North Little Rock, AR 72118 (complete systems).

INTERSAT CORPORATION, 2 Hood Dr., St. Peters, MO 63376 (receivers).

JANEIL SYSTEMS, 17335 Knapp St., Northridge, CA 91325 (complete systems, computer controlled receivers).

JJT DISTRIBUTING, 17210 Yukon Ave., Suite # 1, Torrance, CA 90504 (modulators).

KAUL-TRONICS, Rt. 1, Box 292, Lone Rock, WI 53556 (complete systems).

KLM ELECTRONICS, INC., P. O. Box 816, Morgan Hill, CA 95037 (receivers, complete systems).

LEKTRONICS CORPORATION, 2405 De La Cruz Blvd., Santa Clara, CA 95050 (TVRO equipment).

LINDSAY AMERICA Consumer Electronics Division, 2608 E. Hills Dr., Williamsport, PA 17701 (complete systems).

LULY TELECOMMUNICATIONS CORP., P. O. Box 2311, San Bernardino, CA 92406 (antennas).

MacLINE, INC., West 3125 Seltice Blvd., Couer d'Alene, ID 83814 (complete systems).

McCULLOUGH SATELLITE SYSTEMS, Rt. 5, Box 97, Salem, AR 72576 (complete systems).

MECA, Div. of Marine Electronics Corp., 356 South Blvd., Lake City, SC 29560 (complete systems).

MERRIMAC INDUSTRIES, INC., 41 Fairfield Place, P. O. Box 986, West Caldwell, NJ 07006 (receivers, power splitters).

MICRODYNE CORP., P. O. Box 7213, Silver Springs Industrial Park, Ocala, FL 32670 (receivers, antennas).

MICROELECTRONICS TECHNOLOGY CO., 2446 Watson Court, Palo Alto, CA 94303 (modular microcircuits).

MICROWAVE ASSOCIATES COMMUNICATIONS, 121 Middlesex Turnpike, Burlington, MA 01803 (complete systems, TVRO components).

MICROWAVE FILTER CO., INC., 6743 Kinne St.,Syracuse, NY 13057 (filters).

MICROWAVE CONSULTANTS, 5720 S. University, Little Rock, AR 72209 (complete systems).

MICROWAVE GENERAL CORP., 1100-A Lavenida Ave., Mountain View, CA 94043 (complete systems).

MID-AMERICA VIDEO, P. O. Box 511, North Little Rock, AR 72115 (complete systems).

NATIONAL MICROTECH, INC., P. O. Box 417, Grenada, MS 38901 (complete systems).

NATIONAL SATELLITE COMMUNCIATIONS CORP., 1208 Troy-Schenectady Rd., Latham, NY 12110 (complete systems).

NATIONAL SATELLITE SYSTEMS, 4800 Pan American Freeway N. E., Albuquerque, NM 87109 (complete systems).

NEWTON ELECTRONICS, INC., 2218 Old Middlefield Way, Mountain View, CA 94043 (signal simulator test sets).

PCM POWER CONSULTANTS MICROWAVE, 1503 Breckenridge Dr., Little Rock, AR 72207 (complete systems).

PRODELIN INC., P. O. Box 131, Hightstown, NJ 08520 (antennas).

QUANTUM ASSOCIATES, INC., Box 18, Alpine, WY 83128 (antenna drives).

RGH DIGITAL LABS, P. O. Box 58, Prairie Du Chien, WI 53821 (receivers).

R. L. DRAKE COMPANY, 540 Richard St.,Miamisburg, OH 45342 (receivers).

R & R ASSOCIATES, 3106 Glendon Ave., Los Angeles, CA 90034 (tuners, modulators, TVRO components).

SAGINAW STEERING GEAR DIVISION, General Motors, 3900 Holland Rd., Saginaw, MI 48605 (linear actuators).

SATELCO, 5540 Pico Blvd., Los Angeles, CA 90019 (complete systems).

SATELINC, Riverside Dr., Chestertown, NY 12817 (complete systems).

SATELLITE RECEIVING SYSTEMS, 1515 Jarvis Court, San Jose, CA 95118 (complete systems).

SATELLITE SUPPLIES, INC., 164-B Gilman Ave., Campbell, CA 95008 (receivers).

SATELLITE SYSTEMS UNLIMITED, 1052 Harrison St., P. O. Box 43, Conway, AR 72032 (antennas).

SATELLITE TECHNOLOGY SERVICES, INC., 11684 Lilburn, St. Louis, MO 63141 (complete systems).

SATFINDER SYSTEMS, 5146 South 94th East Ave., Tulsa, OK 74145 (complete systems).

SATSHARE INC., 5301 Hollister, Houston, TX 77080 (complete systems).

SAT-TEC SYSTEMS, 2575 Baird Rd., Penfield, NY 14526 (receivers).

SCIENTIFIC ENGINEERING ASSOCIATES INC., 1725 E. Mohave St., Phoenix, AZ 85034 (down converters, tuners, modulators).

SKYSEARCH SATELLITE SYSTEMS, INC., P. O. Box 978, Hwy 501, Conway, SC 29526 (complete systems).

SPACEAGE ELECTRONICS, P. O. Box 15730, New Orleans, LA 70175 (antenna motor drives, controls).

STARK & ASSOCIATES, INC., 641 Grayson Hwy, Lawrenceville, GA 30245 (cable & connectors).

STAR VIEW SYSTEMS, Rt. 3, Box 103G, Pocahontas, AR 72455 (complete systems).

STRATOVISION CORPORATION, P. O. Box 832, Jacksonville, AR 72076 (complete systems).

TDF CORPORATION, P. O. Box 156, Neosho, MO 64850 (antennas, programmable antenna controls).

TRANS-SAT CORPORATION, 2000 N. Main, P. O. Box 14, Junction, TX 76849 (complete systems).

TRANSVISION CORPORATION, 2100 Redwood Hwy, Greenbrae, CA 94904 (complete systems).

UNITED SATELLITE SYSTEMS, RR 1, St. Hilaire, MN 56754 (complete systems).

U.S.A. #1 VIDEO, 1201 N. Pine, North Little Rock, AR 72115 (complete systems).

VAN'S ELECTRONICS 1840 N. Tustin Ave., Orange, CA 92665 (complete systems).

VIA-SAT COMMUNICATIONS, 1664 Lancelot, Arlington, TX 76014 (complete systems).

WATKINS-JOHNSON, 3333 Hillview Ave., Palo Alto, CA 94304 (voltage controlled oscillators).

WILSON MICROWAVE SYSTEMS, INC., 4286 S. Polaris Ave., Las Vegas, NV 89103 (complete systems).

WINEGARD COMPANY, 3000 Kirkwood, Burlington, IA 52601 (complete systems).

PRIVATE TERMINAL DATA / MANUALS / INFORMATION

The following firms and products are available to increase your knowledge of or participation in low cost satellite television technology.

AETN (American Educational Television Network) - 2172 Du Pont Drive, Irving, CA 94715 (Operates extensive via-satellite post graduate training program for doctors, other professional groups. Programs can be seen for two to three hour periods, seven days a week on Transponder 16 of Satcom III.

FEDERAL COMMUNICATIONS COMMISSION - 1919 M Street N.W., Washington, D.C. 20554. (Source for data federal government regulation of TVRO terminals.)

S.P.A.C.E. (Society for Private and Commercial Earth Stations) - 1920 N. Street Northwest, Suite 510, Washington, D.C. 20036 (International organization for private and commercial satellite terminal owners/operators.)

TV GUIDE - P. O. Box 400, Radnor, PA 19088 (Some regional editions carry satellite programming.)

SATELLITE TV WEEK - published by Fortuna Publishing Company, P. O. Box 308, Fortuna, CA 95540 (A guide to the latest in sky TV watching.)

THE SATELLITE CHANNEL CHART - published by Westsat Communications, P. O. Box 434, Pleasanton, CA 94566 (Complete programmer listings for all North American satellites.)

SAT-GUIDE - P. O. Box 1700, Hailey, ID 8333 (A uniquely formatted "super TV Guide" to all major satellite programs and services. Published monthly.)

SATELLITE PROGRAMMING SOURCES (SATCOM III)

The following firms operate the programming transponders (or "channels") on RCA's Satcom III. Some of these groups grant private home viewers permission to view their offerings, others do not. It is suggested that each be contacted.

Transponder Number	Service	Contact
T-1	Nickelodeon Arts	Gary Koester Margaret Wade (Warner-Amex, 1211 Ave. of Americas, New York, NY 10036 (212-944-4250)
T-2	PTL (Praise The Lord	Walter Warren (7224 Park Ave. Charlotte, NC 28279) (704-524-6000)
T-3	WGN (Channel 9, Chicago)	Roy Bliss (United Video, 5200 S. Harvard, Suite 215, Tulsa, OK 74135) (800-331-4806)
T-4	Spotlight	Donna Lawrence (2951 28th St., Suite 2000, Santa Monica, CA 90405) (213-450-6488)
T-5	The Movie Channel	Gary Koester (Warner-Amex, 1211 Ave. of Americas, New York, NY 10036) (212-944-4250)
T-6	WTBS (Channel 17, Atlanta)	Nory Le Brun (1050 Techwood Dr. NW, Atlanta, GA 30318) (404-898-8500)
T-7	ESPN (Entertainment and Sports Programming Network)	Jim Cavazzini (ESPN Plaza, Bristol, CT 06010) (203-584-8477)
T-8	CBN (Christian Broadcasting Network)	Clay Boudreaux (Virginia Beach, VA 23463) (804-424-7777)
T-9	BET (Black Entertainment Network)	Vivian Goodier (3222 N St. NW, Suite 300, Washington, DC 20007) (202-337-5260)
T-9	USA Cable Network	Ken Kinderman (1271 Ave. of the Americas, New York, NY 10020) (212-484-1866)
T-10	Showtime (West)	John Sie (1633 Broadway, 37th Floor, New York, NY 10019) (212-880-6791)
T-11	MTV (Music Television)	Gary Koester (Warner-Amex, 1211 Ave. of the Americas, New York, NY 10036) (212-944-4250)
T-12	Showtime (East)	(See T-10)

T-13	HBO (Home Box Office) West	Pam Brady (Time-Life Bldg., Rockefeller Plaza, New York, NY 10020 (212-484-1208)
T-14	CNN (Cable News Network)	Nory Le Brun (1050 Techwood Dr. NW, Atlanta, GA 30318) (404-898-8500)
T-15	CNN2	(See T-14)
T-16	ACSN (Appalachian Community Service Network)	Linda Resnik (1200 New Hampshire Ave. #240, Washington DC 20036) (202-331-8100)
T-16	CMN (Christian Media Network)	Lloyd Hart (P. O. Box 20121, Bloomington, MN 55420) (612-884-4540)
T-16	NTV (National Jewish Television)	Joel Levitch (2621 Palisade Ave., Riverdale, NY 10463) (212-549-4160)
T-16	AETN (American Educational TV Network)	Irene Billiras (2172 Du Pont Dr., Irvine, CA 94715) (800-854-7387)
T-16	Oral Roberts	Dave Moore (Traco Box 8286, Tulsa, OK 74101) (918-492-6161)
T-16	Good Stuff	Chet Tomczyk (Box A, Bloomington, IN 47402) (812-339-2203)
T-16	Episcopal TV Network	Rev. Chas. Sumners, Jr. (Bx 2060 Grand Central St., New York, NY 10163) (212-888-1862)
T-17	WOR (Channel 9, New York City)	Mary Cotter (Eastern Microwave, P. O. Box 4872, Syracuse, NY 13221) (315-455-5955)
T-18	Galavision (Spanish Language)	Starrett Berry (250 Park Ave., New York, NY 10017) (212-953-7550)
T-18	Reuters Monitor Service	Roger Pavane (2 Wall St., New York, NY 10005) (212-732-2400)
T-19	C-Span	Jana Dobrowski (400 N.Capitol St.,Suite 155, Washington, DC 20001) (202-737-3220)
T-20	Cinemax (East)	(See T-13)
T-21	HTN (Home Theatre Network)	Steve Broydrich (465 Congress St., Portland, ME 04101) (207-774-0300)

T-21	The Preview Channel	James Speck (73 Market St., Venice, CA 90291) (213-392-9575)
T-22	MSN (Modern Satellite Network)	Jay Campbell (45 Rockefeller Plaza, New York, NY 10020) (212-765-3100)
T-23	Cinemax (West)	(See T-13)
T-24	HBO (East)	(See T-13)

SATELLITE TERMINAL PLANS/MANUALS

All of the following manuals and aids are available exclusively through Satellite Television Technology (P. O. Box G, Arcadia, Oklahoma 73007; (405)396-2574). Terms are payment with order; outside of USA, note price differences and that all funds must be in US dollars. Order form on last page of this Handbook.

(a)**HOWARD TERMINAL MANUAL** - the first high quality, 24 channel tuneable receiver made available in build-it-yourself detail was designed by Stanford University's Taylor Howard. The "Howard Terminal Receiver" has been duplicated by thousands of builders and currently there are circuit boards and some parts kits also available (listed with the manual). Many of the commercial (private) receivers now being offered for sale began as the Howard Receiver design. This manual shows how to build it, gives full schematics and construction hints; the receiver can be duplicated today for under $700. Taylor Howard maintains a low-cost one-on-one (by mail) consulting service as an option for manual buyers. Manual price is $30 per copy or it may be combined with the NELSON TVRO PARABOLIC ANTENNA MANUAL for a special package price of $50.

(b)**WASHBURN HIGH PERFORMANCE TVRO RECEIVER MANUAL** - Here is the ultimate, super-deluxe home receiver. Superb performance on weaker signals, careful attention to optimizing audio and video response, automatic selection of vertical and horizontal (inter-leaved) transponders with an easy-chair remote control. A commercial supplier offers this receiver wired and tested for $1995.00. **HOWEVER** - we do **not** recommend this "project" to you unless you have reasonably solid electronics background and have built projects such as **HEATHKIT** television receivers previously. This manual is priced at $40.

(c)**NELSON TVRO PARABOLIC ANTENNA MANUAL** - If you want to tackle building your own 10 or 12 foot backyard parabolic, here is the manual for you! Nelson Ethier has refined parabolic antenna construction (including the mount and the feedhorn) to a specific set of clearly understood instructions. In around 25-35 hours of your time and perhaps $400 of your money you can duplicate this high performance parabolic antenna system which makes use of the combined technologies of "metal" and "fiberglass". Even if you intend to buy a parabolic antenna, having this manual in your library and fully understanding it will make you a much "sharper" buyer of a commercial product as it will aid you in recognizing good and bad points in commercial antennas. This manual is priced at $30 per copy.

(d)**COOP'S SATELLITE OPERATIONS MANUAL** - This is a handbook for the operation of your private earth receiving terminal. Coop goes into detailed discussions of how the various satellite sub-systems work (including telephone message traffic, audio channels, teletype and message traffic), how each satellite system is different and what adaptions and modifications you need to make to your system to receive each. The purpose of this manual is to give the satellite terminal

user a reliable set of reference material so that he or she can obtain maximum use and enjoyment from the private satellite terminal. This one explains the operational mysteries! Price of this manual is $30.

(e)**GIBSON SATELLITE NAVIGATOR MANUAL** - a manual to assist you in understanding how your TVRO/ARO antenna system must be designed, constructed and operated so that your system will be able to access the full geostationary/Clarke orbit belt of satellites...a complete guide to designing a ground mounting system for your antenna plus construction details on mechanical and computer driven antenna mounting systems for automating the satellite-changing function of your terminal system. The price is $30.

(f)**COOP'S SATELLITE BUSINESS OPPORTUNITY MANUAL** - a manual to guide you into the business of selling and installing home (private) satellite TV terminals. This Bob Cooper manual tells you what to watch out for, and how to make it in this tough, new business enterprise area. It's the inside story of all of those products now appearing in the satellite field and what you need to know to make them work for you as a "packaged system" which you can sell as a dealer in your area. Frank, honest, down to earth. This manual is priced at $50.

(g)**COOP'S BASIC MANUAL** - getting optimum performance from a TVRO installation is no accident. This is a world of little things. Peak performance of a satellite terminal depends upon how well you follow the experience of others in selection and installation of your antenna, feed, LNA and all associated cables and connectors. This manual is all about the basics of properly preparing and installing coaxial connectors, tweeking receivers for optimum performance, finding the focal point with an antenna feed and much more! This manual is priced at $30 per copy.

(h)**LOW POWER TV HANDBOOK** - in the first 90 days after official announcement of this new service of Low Power TV, the FCC received more than 3,000 applications for LPTV. In this co-authored Handbook, Rick Brown and Bob Cooper explain the ramifications of the law, applying for an LPTV outlet and then designing, building and operating the station. Price of this handbook is $60.

SATELLITE RELATED PUBLICATIONS

Here is a list of those publications which contain satellite television information on a regular basis.

(a)**COOP'S SATELLITE DIGEST** - Read worldwide by thousands of owners / operators / builders of low cost or just plain private satellite (TV and audio) terminals. Each issue contains two complimentary sections. The "Technical Section" reports on new circuits for improved receivers and LNAs plus gives tips and construction news on new antennas, modulators and other gadgets which make satellite TV reception better. The "Programming Section" details the latest news in satellite activity, which transponder is being used by whom for what (and when!), plus it gives timely reports on the development of the marketing arm of the industry as hundreds of new dealers and distributors enter the field to sell "private" terminals. This is "The Book" of the industry. Mailed via first class mail the first week of each month; high quality printing, artwork and photos. A one-time sample copy price of $5.00 ($7.50 outside of USA/Canada/Mexico), or an annual subscription price of $50 ($75 outside of USA/Canada/Mexico). See order form on last page of Handbook.

(b)**SAT-GUIDE** - a uniquely formatted "super TV Guide" to all of the major programming sources found on SATCOM FIII transponders and COMSTAR D2 transponders. Done one month per edition, this is a thick guide that separates movies, specials and

sporting events into special sub-sections for easy reference. Basically, if it is "on the bird", you'll find the program listed here. Price is $36 per year from Sat-Guide, Box 1700, Hailey, Idaho 83333.

SATELLITE PRIVATE TERMINAL SEMINARS

Satellite Television Technology holds three "SPTS Events" per year, at various US locations. The concept is to bring together between 500 and 1,000 satellite "pioneers" with a couple dozen of the best engineers, technicians and system operators in the world. Each SPTS is operated by scheduling twin-seminar sessions (one technical, one not so technical) over a three day period so that you are exposed to approximately 25 hours of live discussions and demonstrations covering the very latest in low cost receiving terminal system technology. Typically, 50 or more commercial exhibits are on hand where the industry's equipment suppliers show off their products. Virtually all equipment manufacturers are anxious to have new dealers and distributors and the SPTS events reflect this fact with hundreds of "deals" made at each event.

(a)**At the time of this publication**, the next STT Seminar will be the National Satellite Opportunity Conference, to be held at the Tarrant County Convention Center in Fort Worth, Texas, on March 26, 27 and 28, 1982. The pre-registration fee is $60.00 ($70 at the door) which includes entry to all seminar sessions and exhibit areas. For information regarding this Conference and future seminars, contact STT, P. O. Box G, Arcadia, OK 73007 (405-396-2574 or 405-396-2336).

SATELLITE LOCATIONS / TRANSPONDER USE

Satellite locations in space are typically maintained within a "box" or rectangle in space that is 70 miles on an east-west side, 50 miles on an up-down side. Ground control station "flight engineers" maintain the satellite within these prescribed "boxes" to insure that earth located receiving stations (as well as uplink stations) will not lose "view" of the satellite once the antenna is "homed in" on the bird. The following information relates the nominal location of the various satellites of interest to western hemisphere (i.e. North, Central and South America) viewers. For a **full** set of all satellites see **"Worldwide Communication Satellites Wallchart"** from STT:

Bird Name	Location
INTELSAT IV-E	1.0 degrees west
INTELSAT IV-A	2.6 degrees west
SYMPHONIE I	11.6 degrees west
GHORIZONT 2	14.2 degrees west
INTELSAT IV-B	18.5 degrees west
INTELSAT IV-AA	24.6 degrees west
INTELSAT IV-AB	27.5 degrees west
INTELSAT IV-AC	34.5 degrees west

The above group of "birds" is located in a "cluster" and is primarily intended to serve users in Europe, Africa, South America and the eastern portion of North America.

COMSTAR III	86.9 degrees west
WESTAR III	90.9 degrees west
COMSTAR II	95.0 degrees west
WESTAR I	99.0 degrees west
ANIK I	103.9 degrees west
ANIK II	106.5 degrees west
ANIK-B	108.9 degrees west
ANIK III	113.9 degrees west
SATCOM II	118.9 degrees west
WESTAR II	123.4 degrees west
COMSTAR I	127.8 degrees west
SATCOM III	131.0 degrees west
SATCOM I	134.9 degrees west

The above group make up the television carrying or television capable North American "domestic" satellites now in operation.

INTELSAT IV-F	177.1 degrees west

The above satellite is the only routinely operational satellite carrying television programming over the Pacific Ocean.

As noted in the main seciton of this Handbook, there are two primary types of "video service" available on satellite. The "occasional feed" video appears when there is an event to be televised, and relayed, from one point to another. Such a feed is scheduled on a specific transponder and on a specific satellite perhaps only hours prior to the actual event beginning. Thus there is no way to know in advance exactly which satellite or transponder may be carrying such an event.

Within the US domestic satellite "family" transponders on WESTAR I, II and III plus transponders on COMSTAR II and SATCOM II are most likely to carry such "occasional video" feeds. Outside of the US, INTELSAT occasional video is found most often on a frequency of 4184.25 or 4165.75 MHz. Audio, if carried on the same transponder, is typically 5.8 or 6.6 MHz "sub-carrier". Audio on SATCOM is typically on a 6.8 MHz "sub-carrier" while audio on WESTAR is typically on 6.2 MHz "sub-carrier". On COMSTAR, 6.6 MHz and 5.8 MHz are common (these are for "occasional" video feeds only).

The other video "format" is regularly-scheduled programming. This group is subject to some change at the whim of the satellite operator. However, the "transponder channel assignments" for the major services at presstime for this edition of the Handbook are as follows:

(a)**BrasilSat** Feed via INTELSAT IV-AA (24.6 degrees west): Video on 4143 MHz, audio on 6.6 MHz "sub-carrier". Programming hours approximately 8 AM eastern to 1 AM eastern.

(b)**COMSTAR III** - no reguarly scheduled video at present time although "occasional video" is reported on transponders 4, 23; usually sporting events.

(c)**WESTAR III** - no regularly scheduled video at present time although "occasional video" is reported on transponder 6 around 5 PM eastern most days.

(d)**COMSTAR II**

Six programmers are now using transponders on this satellite.

Transponder Number	Service
6	Bravo
7	Escapade
7	NCN (National Christian Network)
13	Cinemax (East)
17	TBN (Trinity Broadcasting Network)
18	HBO (East)

(e)**WESTAR I** - Heavily used for the Public Broadcasting System (PBS) with regularly scheduled video for PBS and the networks on 1, 2 and 6.

(f)**ANIK-B** - Well received in USA in spite of Canadian coverage pattern. French language television 18 hours per day on transponder 8, English on transponders 10 and 12; occasional (CBC feed) video on transponder 7.

(g)**ANIK III** - Well received in northern US but service (1 French, 2 English) largely being moved over to ANIK-B. Video here will consist of coverage on Canadian House of Commons.

(h)**SATCOM II** - This was the first "cable TV bird", cable traffic was moved to FI in June of 1978. Typical use at present for video is as follows: **Transponder 1** carries ABC, CBS, NBC, PBS programming to Anchorage, Alaska where it is videotaped for later distribution to "Alaskan Bush Terminals" on transponder 23. **Transponder 8** is used by NBC to link Hollywood and New York studios for special video feeds. **Transponder 9** is used to relay Armed Forces Radio (&) Television Service to American bases such as Guantanamo Bay, Cuba. **Transponder 23** carries "Alaskan TV Network" although audio may on occasion be on a special transponder 3 carrier separate from the video (requiring two receivers).

(i)**WESTAR II** - Mexico City's XEW network frequently utilizes

transponder 1 for video relay to US (and Mexican) affiliated stations. Transponder 7 is in use 12-14 hours per day by Spanish International Network (SIN) for relay of US and Mexican Spanish language programming to US affiliated stations. Occasional feed video, often news items, are found on transponder 1, 4 and 12 in the 4 PM to 7 PM (eastern) time slot.

(j) **SATCOM III** - This is now the cable industry's principal satellite. Programming sources and a brief description of each follows:

TRANSPONDER 1 is a 16-hour per day children's television network called Nickelodeon, programmed by Warner-Amex. Balance of the time used is by ARTS, a presentation of performing, visual and lively arts.

TRANSPONDER 2 is PTL (People That Love). Viewing includes talk, variety, children's shows, drama and specials from around the world.

TRANSPONDER 3 is Chicago non-network station WGN, on the air 24 hours a day, featuring movies, sports, specials and syndicated programs.

TRANSPONDER 4 is Spotlight, featuring excellent motion pictures, specials and some foreign and classic films.

TRANSPONDER 5 is The Movie Channel, a 24 hour per day movie and specials service.

TRANSPONDER 6 is Atlanta non-network station WTBS, the Ted Turner station that pioneered this service. On the air 24 hours per day.

TRANSPONDER 7 is ESPN (Entertainment and Sports Programming Network). They provide live and taped sporting coverage 24 hours a day.

TRANSPONDER 8 is CBN (Christian Broadcasting Network), a 24 hour per day religious network.

TRANSPONDER 9 is BET (Black Entertainment Network), presenting programming featuring black performers in feature films, classics, music specials and sports.

TRANSPONDER 10 is the west coast (time zone) feed for Showtime, a premium movie / special service 24 hours per day.

TRANSPONDER 11 is MTV (Music Television), an all stereo music channel featuring the best selling recording artists who sing and/or act out their songs.

TRANSPONDER 12 is the east coast (time zone) feed for Showtime.

TRANSPONDER 13 is the west coast (time zone) feed of HBO, a full service complement of first run movies, sports and entertainment specials.

TRANSPONDER 14 is CNN (Cable News Network) with 24 hours per day coverage of news, weather, sports and other features.

TRANSPONDER 15 is CNN2 (Cable News Network), a fast moving brief coverage of all the latest news, delivered every 30 minute in six minutes sections.

TRANSPONDER 16 is ACSN which offers cultural and educational programming from all parts of the country as a public service.

TRANSPONDER 16 also offers religious programming by Oral Roberts, the Christian Media Network, Good Stuff (programming for children), the National Jewish Television and the American Educational TV Network.

TRANSPONDER 17 is utilized by New York City's WOR, a non-network station, on the air 24 hours a day.

TRANSPONDER 18 is Galavision, a Spanish language service offering first run films, specials and sporting events from Mexico, Latin America and Spain. This transponder is also used by Reuter's News Service to transmit special live wire and financial news services during the daytime.

TRANSPONDER 19 is C-Span, daily live coverage of the House of Representative Congressional hearings and National Press Club luncheons.

TRANSPONDER 20 is Cinemax (East) which complements HBO as a good service.

TRANSPONDER 21 is HTN (Home Theater Network) which is a movie package of family entertainment from 7 PM to 1 AM daily. In other hours, this transponder carries the Preview Channel, covering TV pilots, film clips, movie trailers and previews.

TRANSPONDER 22 is MSN (Modern Satellite Network) which features information, opinion and entertainment for the general consumer.

TRANSPONDER 23 is the west coast section of Cinemax.

TRANSPONDER 24 is the east coast section of HBO.

AUDIO SERVICE VIA SATELLITE

Where it is possible to send one television picture (with accompanying sound) via a single satellite transponder channel, many times as many "program channels" carrying audio (voice / music) or data (teletype, etc.) can be fitted onto a transponder. One of the fastest growing satellite expansion areas is for radio program networks and news networks to deliver their services directly to the radio station / newspaper customers via satellite.

We are just now witnessing the beginning of a substantial, new industry in this area and in the 1980-81-82 timeframe virtually every radio station and newspaper in America will sprout comparatively small (4-10 foot) parabolic antenna pointed at a satellite. Via these "narrow band" satellite links will come the latest radio news reports, written (as in teletype) news stories, news-wire-photos and other material which keeps the media services up to date and on time.

Early efforts in this area include substantial news services. The so-called "audio-only" (which may in truth be teletype and facsimile photos as well) terminals are already in operation at several hundred transmissions **with a satellite TV terminal** requires a modestly priced adapter connected to the basic TVRO television receiver. It is inevitable that even lower priced "audio-only" receive terminals, employing smaller-than-TV dishes and less complicated-than-TV receivers will come on the marketplace shortly.

Some of the present day (early users) of this service include:

(a)**WESTAR I** - Presently four, soon to be 12 audio channels for National Public radio, on transponder 6.

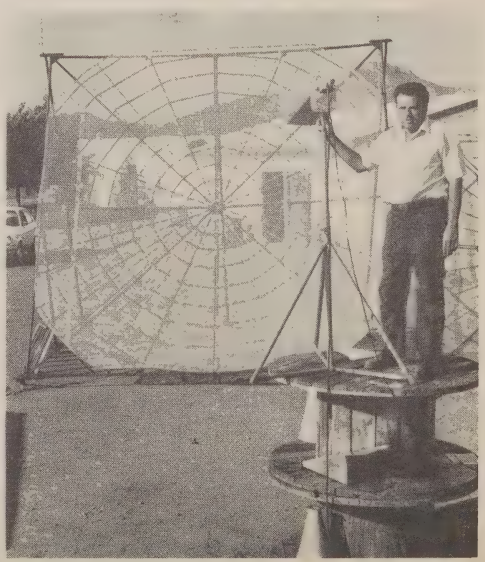
(b)**SATCOM II** - On transponder 16, the following "narrowband" services: NBC Central, NBC Radio Network, CBS Central, CBS Radio Network, ABC Mountain / Pacific Radio Network, National Black Radio Network, Associated Press Radio Network, Associated Press teletype, United Press International Audio News, United Press International teletype, RKO Radio Network, International Services, Voice of America #'s 1, 2, 3 and 4.

For details on how to tune in these non-video services, see **"Coop's SATELLITE OPERATIONS MANUAL"** from STT.

SATELLITES OF THE FUTURE

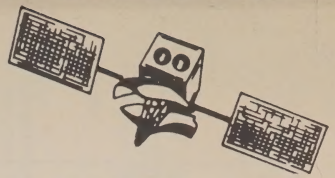
Delta Launchings Through 1984

Serial No.	Mission	Launch Date
159	RCA Satcom 4	Jan. 14, 1982
160	Westar 4	Feb. 25, 1982
161	Insat 1-A (India)	Apr. 8, 1982
162	Landsat D	Jul. 1, 1982
163	Anik-D1 (Canada)	Aug. 12, 1982
164	Westar 5	Sep. 30, 1982
165	RCA Satcom 5 (Alascom 1)	Nov. 18, 1982
166	IRAS (scientifc)	Jan. 13, 1983
167	RCA Satcom 1-R	Mar. 3, 1983
168	GOES F (weather)	Apr. 21, 1983
169	Hughes Galaxy 1	Jun. 9, 1983
170	AT&T Telstar 3-1	Jul. 28, 1983
171	Landsat D1 (earth obs.)	Callup
172	Hughes Galaxy 2	Sep. 15, 1983
173	NATO-III D (military)	Ot. 27, 1983
174	RCA Satcom 2-R	Dec. 8, 1983
175	GSTAR 1	Apr. 19, 1984
176	AT&T Telstar 3-2	May 31, 1984
177	Hughes Galaxy 3	Jul. 12, 1984
178	AMPTE (scientific)	Aug. 23, 1984
179	GSTAR 2	Sep. 27, 1984
180	Comsat (Satellite TV) 1	Nov. 1984
181	NATO-III E (military)	Dec. 1984



OLIVER SWAN and his innovative "Spherical Reflector" for satellite reception.

STT SATELLITE MATERIALS ORDER FORM



Additional reference/construction materials available from Satellite Television Technology are described in this edition of the Satellite TV Handbook. You may use this order form to purchase these items.

BASIC MATERIALS

1)_____**HOME SATELLITE TV HANDBOOK** - please send an additional copy of this Handbook; $7.50 enclosed (US, Canada, Mexico; $9.00 elsewhere via first class mail).

2)_____**WORLDWIDE COMMUNICATION SATELLITES WALLCHART** - (normally supplied as part of the Satellite Study Package) - please supply a copy of the latest Wallchart; $6.00 enclosed (US, Canada, Mexico; $8.00 elsewhere via first class mail).

3)_____**SATELLITE STUDY PACKAGE** - includes the above Handbook and Wallchart; $12.00 enclosed (US, Canada, Mexico; $16.00 elsewhere via first class mail).

4)_____**SAMPLE COPY - "COOP'S SATELLITE DIGEST"** - please send a recent issue sample copy of CSD; $5.00 enclosed (US, Canada, Mexico; $7.50 elsewhere via first class mail). See below for full subscription.

TVRO CONSTRUCTION MANUALS

5)_____**HOWARD TERMINAL MANUAL** - construction of the very popular Taylor Howard TVRO terminal. $30 per copy (US, Canada, Mexico; $35 elsewhere via first class mail).

6)_____**NELSON PARABOLIC TVRO ANTENNA MANUAL** - build your own parabolic antenna and save money! $30 per copy (US, Canada, Mexico; $35 elsewhere via first class mail).

7)_____**HOWARD plus NELSON PACKAGE** - both of these best-seller manuals in a money-saving special package. $50 per set (US, Canada, Mexico; $55 elsewhere via first class mail).

8)_____**WASHBURN HIGH PERFORMANCE TVRO RECEIVER MANUAL** - high quality manual described circuits, construction, alignment for top-of-the-line performing receiver system. $40 per copy (US, Canada, Mexico; $45 elsewhere via first class mail).

9)_____**COOP'S SATELLITE OPERATIONS HANDBOOK** - get the most from your terminal by knowing where to look for what, and how! $30 per copy (US, Canada, Mexico; $35 elsewhere via first class mail).

10)_____**GIBSON SATELLITE NAVIGATOR MANUAL** - make your antenna track "all" the birds, and, make it automatic! $30 enclosed (US, Canada, Mexico; $35 elsewhere via first class mail).

11)_____**COOP'S SATELLITE BUSINESS OPPORTUNITY MANUAL** - how to get into the sales end of home terminals, safely. $50 enclosed (US, Canada, Mexico; $55 elsewhere via first class mail).

12)_____**COOP'S BASIC MANUAL** - the nitty-gritty of getting top system performance, all the time; learned the hard way! $30 enclosed (US, Canada, Mexico; $35 elsewhere via first class mail).

13)_____**LOW POWER TV HANDBOOK** - the complete step-by-step layout to go "on the air" with a satellite connected to 1,000 watt "low power" TV station. $60 enclosed (US, Canada, Mexico; $65 elsewhere via first class mail).

14)_____**COOP'S SATELLITE DIGEST - ONE YEAR SUBSCRIPTION** - to the monthly "journal" of the low-cost satellite TV world. Price is $50 per year (US, Canada, Mexico; $75 elsewhere via first class mail).

NOTE: STT **does not invoice**; please do not send purchase orders. Full payment (in US funds only please!) must accompany all orders. We do accept Visa and Master Card **except** on subscriptions for Coop's Satellite Digest.

Credit Card No. _____

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COMPANY (if applicable) _____

ADDRESS _____

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Send Order and
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P. O. Box G
ARCADIA, OKLAHOMA 73007

2:00C 1:00M 12:00P
THE LUNDSTROMS
MOVIE -(MUSICAL-COMEDY) ** ½
Naughty Marietta" 1935 Jeanette
MacDonald, Nelson Eddy. A French Princess
flees off to America, and falls in love with an
Indian scout. (2 hrs.)
MCHALE'S NAVY
MOVIE 'Fade to Black'
MOVIE-(SUSPENSE-DRAMA) ** "Student
Connection" 1975 Ray Milland, Sylva Koscina.
The headmaster of a fashionable boy's school
uses an assassin to kill his mistress' husband.
(2 hrs.)
2:30C 1:30M 12:30P
REX HUMBARD
SPORTSCENTER
JACK BENNY SHOW
MARVIN HAMLISCH: THEY'RE PLAYING MY
SONG Liza Minelli, Johnny Mathis, Gladys
Knight, Carly Simon and the Los Angeles
Philharmonic join Marvin Hamlisch for a
musical celebration of his greatest hits.
MOVIE-(HISTORICAL) ** ½ "Alfred The
Great" 1969 David Hemmings, Michael York.
A warrior King is torn between his desire to
find the ascetic life of a religious scholar and
the demands of his people that he fight the
encroaching Danes. (2 hrs., 2 mins.)
3:00C 2:00M 1:00P
PROGRAM UNANNOUNCED
MOVIE -(COMEDY) ***
'74 Ru...
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